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"MUNICIPAL JOURNAL" and "CONTRACTING"

GRADING MACHINE EXCAVATING TO SUBGRADE AFTER REMOVAL OF OLD PAVEMENT AT 5TH AND COMMERCE STREETS, PHILADELPHIA.

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A New Idea in Cast Iron Pipe Joints

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SEPTEMBER 25, 1920

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CITY **COUNTY** **STATE**

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 **FLORAL PARK, SEPTEMBER 25, 1920** **No. 13**

Recut Granite Block Paving in Philadelphia

Difficult conditions on arterial street with heavy traffic on street, trolley and elevated tracks. Old pavement replaced by old blocks redressed and set on foundation of concrete mixed at distant plant.

AUTO TRUCK DELIVERING CONCRETE MIXED AT CENTRAL PLANT, TO WEST SHOULDER OF FIFTH STREET, SOUTH OF VINE STREET.

This year, Philadelphia is spending about $4,000,00 on 213 paving contracts, 15 of which are large ones. The work includes about 60 miles of streets with different types of pavements including about 1 mile on Kensington Ave. and Front St., an arterial thoroughfare 60 feet wide with a heavy vehicular traffic, two lines of trolley tracks and an elevated railroad structure overhead.

The work was designed and executed by the bureau of highways, department of public works, city of Philadelphia, Fred C. Dunlap, chief of bureau and Chas. F. Puff, Jr., principal assistant engineer in charge of construction. The contract designated as No. 2593 was awarded in February, 1920, to the Union Paving Company, contractor, for about $101,000 at unit prices based on the preliminary estimate of quantities.

GENERAL DESCRIPTION OF WORK

The principal quantities included the removal of 22,320 square yards of existing granite block pavement and the subgrading at 70c per square yard; furnishing the laying 4,062 cubic yards of 1:3:6: concrete base at $9 per cubic yard; furnishing and laying 22,320 square yards of gravel grit cement cushion course at 23c per square yard; cutting and laying 22,320 square yards of redressed granite block surface including joints $1.50 per square yard; furnishing and filling 43,-

BARRING OUT OLD GRANITE PAVEMENT BLOCKS

925 linear feet of rail channel with cement mortar at 7c per linear foot.

The work was carried out in five successive operations each of them generally covering one 400-foot block although on some occasions the total length was reduced from 5 to 4 blocks. The granite blocks of the old pavement were barred and removed by hand, piled neatly along the curb and the street was carefully excavated to subgrade by a Keystone shovel delivering to motor driven trucks that hauled the spoil two miles to the points where it was disposed of for filling in low ground.

The subgrade was excavated and prepared in one-block lengths, compacted by a 10-ton steam roller finishing it to a surface within ¼ inch of the required elevation. All soft or spongy places were dug out and refilled with coarse sand, gravel, slag or crushed stone rammed solid and afterwards rolled. Around all inlets, manholes and other surface structures, the excavation was made uniformly 4 inches deeper than the regular subgrade for a distance of 12 inches around the structure in order to secure a heavier concrete foundation there.

RECUTTING GRANITE BLOCKS

The blocks were recut by a gang of 25 or 30 expert cutters seated on low seats near the curb who first, with a chisel scored a line across the middle of the wide side of each block with about 4 blows of a 6-pound hammer, then reversed the stone, placing the scored side down on the surface of the ground and by striking the center of the stone one or more blows with a short handle sledge hammer, broke it square and smooth on the scored line, the fractured surface being later invariably laid as the upper surfaces of the paving blocks. The four sides adjacent to the fractured surface were dressed if necessary to give them sufficient regularity and smoothness for the required joint clearance.

For this purpose, two methods were used. In one of them the stonecutter used a short-handle hammer with a head 4 inches long and a 2½ x 2½-inch face, and struck inside of the line to which the stone was dressed. In the other method, the stonecutter use a hammer with a head 8 inches long and a 2½ x 1-inch face with which the blow was struck outside the line. About the same results were obtained by each method, experts each cut and dressed about 600 granite blocks in 8 hours and received 1c per each block cut.

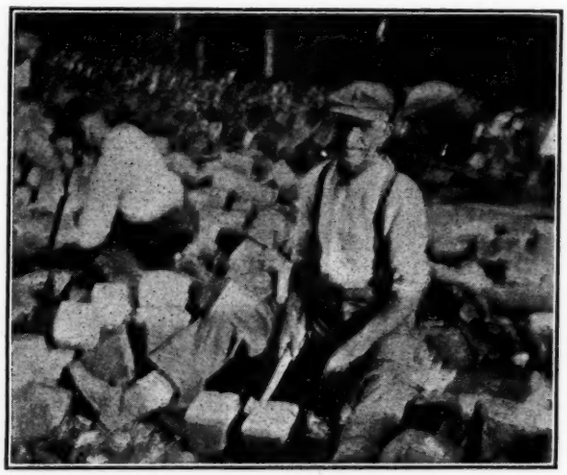
The depth of the shovel excavation varied from 2 to 12 inches, and the work was done with great care to avoid making any holes that are likely to occur with careless operation and although repaired by filling and tamping, are likely to produce irregular spots in the pavements. The steam shovel was followed by a force of hand trimmers that brought the surface up to accurate subgrade, filling in any depressions that were necessary. The surface was rolled with a 10-ton machines until it was levelled within ¼ inch of required elevation, after which traffic was rigidly excluded until the pavement was completed.

CONCRETING

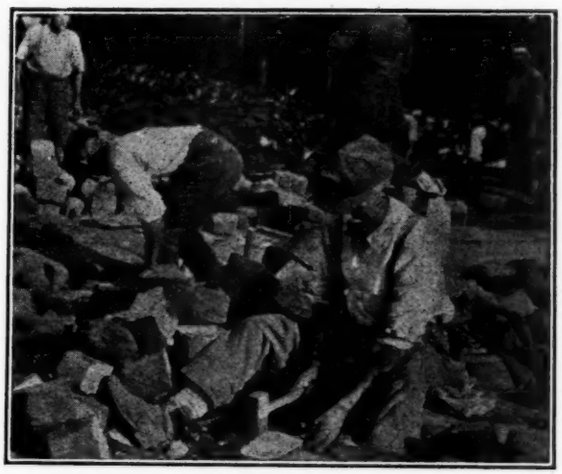
The 1:3:6 concrete for the foundation course 6 inches thick, was made with Portland cement developing a strength of 200 pounds per square inch when 7 days old and 300 pounds when 28 days old. The sand was graded from coarse to fine with grains not exceeding ¼ inch in diameter and not more than 25 per cent of them passing a No. 50 sieve. It cannot contain more than 5 per cent by weight of loam, clay, dirt or other impurities and when tested in bricquets has not less than 75 per cent the strength of similar standard bricquets made with Ottawa sand. The crushed stone is graded from ¼ inch to 1½ inch.

The concrete was machine mixed at the contractor's central plant about 5 miles from the work. The mixer described on page 210 of Public Works, September 4, delivered three 2-bag batches to the loading hopper from which it was discharged into ten or twelve 2-ton automobile trucks, the boxes of which had first been sprayed with crude oil to prevent adhesion of the concrete. The rich concrete was mixed so dry that it could be transporated without disintegration, was covered with tarpaulins and hauled promptly to the job at an average rate, through the congested streets of 10 or 12 miles per hour.

To each truck driver was issued with every load, a numbered printed slip on which was stamped the time at which the concrete was loaded. This slip was presented to the inspector on the job who marked on it the time at which the concrete was received. Without the slip no



BREAKING OLD GRANITE BLOCKS IN TWO



TRIMMING OLD GRANITE BLOCKS

concrete was accepted. Usually the trucks arrived at about 6-minute intervals and at a time 20 to 25 minutes after leaving the mixing plant, although a maximum of 40 minutes was allowed. This maximum was considered conservative since careful observations had shown that concrete of this mixture showed no deterioration up to 1 hour after mixing. Very few loads of concrete were rejected and the system operated satisfactorily, the principal benefit being derived from the elimination of mixers at the site and the consequent prevention of obstruction in the street.

At first the concrete was transported in 5-ton loads but these were found to be larger than the paving gangs could handle satisfactorily, and better results were obtained when the capacity of the trucks was reduced to 2 tons. By this system, more than 1,500 square yards of concrete foundation have been laid in one 8-hour day. The concrete being mixed plastic dry is believed to be uninjured by the hauling and set extra hard so that after 24 hours, it is entirely uninjured by heavy rains immediately after it is placed. The operation of the central concrete plant is a new idea which has been developed under the personal supervision of Mr. Puff with the expectation of perfecting it so that it can be advantageously applied to the most of the concrete paving and thus enabling several mixing stations to be established in different parts of the city so as to reduce the haul to practical lengths for all parts of the work.

The trucks usually deliver the concrete, dump it on the subgrade and after it has been levelled by shovelling and raking, the surface is tamped once with 12 x 12-inch light tampers. After the concrete has set 24 hours, it is covered with from ½ inch to 1 inch of a dry cushion made with four parts of slag grit, and one part of cement, hand mixed and carefully levelled to receive the granite blocks.

SETTING RECUT BLOCKS

The recut blocks were approximately cubical with faces varying between 2¾ and 3½ inches or between 3¼ and 4½ inches maximum. The blocks were carefully set on the slag-cement cushion, fractured surface up, and thoroughly rammed. Blocks differing more than ¼ inch in width were not allowed in the same row. The rows are transverse to the curb. The blocks break joints not less than 3 inches, the joints do not exceed ½ inch in thickness and the blocks were laid 100 feet in advance of ramming to permit proper inspection of the blocks and workmanship. One rammer is required by the specifications to be employed for every two pavers.

The blocks are rammed to a uniform surface, the joints are filled with fresh clean water that penetrates to the cushion below, turns the slag and cement into mortor. This flushing is followed by an application of two coats of 1:1 grout mixed in machines and applied by hand, the second coat following the first as soon as it has set and supplemented if necessary by a third coat sufficient to everywhere fully cover the upper surface of the blocks. The grout is broomed into the joints, and the last coat is finished with a squeegee scraper. Within ½ to ¾ of an hour after the last application of joint grout, the surplus grout left on top is swept into the joints bringing them up flush and full and after the initial set is completed, the surface of the pavement is covered with ½-inch layer of sand evenly spread and sprinkled three time a day for three days when the air temperature is 70 degrees or more. Traffic is not admitted until after 7 days.

The total force employed averaged about 125 men exclusive of those employed at the central concrete mixing plant and inclusive of the trucks drivers delivering the concrete. The amount of work done varied from 800 to 1,200 square yards of pavement per 8-hour shift.

The use of recut granite blocks for Philadelphia streets has been found very advantageous and economical. In one case the blocks taken up and relaid on an arterial street were replaced with asphalt, permitting the blocks to be relaid in another street and thus securing the pavement of two streets at a considerable saving for each.

The satisfactory execution of this contract has been promoted by the rapidity, economy, and elimination of street obstruction due to the reuse of old granite blocks and mixing concrete at the central plant.

FINISHED CONCRETE SHOULDER AFTER THREE HOURS SET

Bituminous Macadam Pavements in Mineral Wells

Penetration pavements five years old have carried heavy loads for the oil fields without destruction and with little cost for maintenance. The author describes how they were constructed and maintained and cuts in them repaired.

By Wm. W. McClendon*

Mineral Wells is perhaps the best known health resort in Texas, with visitors running well up in the thousands. In 1910 the government census gave it a population of 3,905, not including visitors, which were estimated at 5,000. The 1920 census count has not yet been anounnced but the population is estimated at 9,000.

Most of the business and residence streets were paved in 1914 and 1915. As no one dreamed at that time that oil would be discovered in Ranger and that as a result heavy truck loads of pipe and oil well supplies would be hauled from Mineral Wells to the oil fields, the pavements were not built for such heavy traffic. To describe how they have withstood the wear of such traffic for several years is the purpose of this article.

Usually, when a town does its first paving the policy is to select the highest type of pavement, and therefore the costliest, for its business streets. In most instances all available funds are exhausted by the time this paving has been completed, except possibly sufficient to pave a short length of one of the principal residence streets. The writer has known of numerous cases where this has happened and because a greater area had not been covered the city officials were accused of graft by the public, who did not stop to investigate the cost of the work. Because of this feeling of distrust, not only of the former administration but of future ones as well, it would have been difficult to secure a favorable vote for another bond issue, and as a consequence there are few cities in Texas of the size of Mineral Wells that can point to a residence section so almost completely paved as can this city.

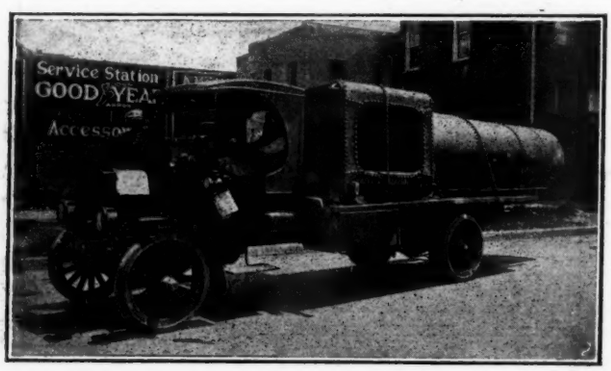
In planning the paving program for this city, the primary condition taken into consideration was what streets should be paved so as to form a connecting link that would serve the entire citizenship to the greatest advantage, and the system was worked out to conform to this. After a careful survey, a bituminous concrete pavement two inches thick on a five-inch concrete base was deemed best for the principal business streets, with a cheaper type of pavement for the less important business streets and streets fifty-two feet wide between curbs, with an eight-inch curb and two-foot gutter. An estimate of the cost of constructing these pavements was made, the funds determined, and the process of working to the originally planned system was begun.

Brick and concrete being eliminated to begin with by their excessive cost, there seemed to be only one type of pavement left to consider, namely, bituminous macadam. Since many engineers are skeptical of bituminous macadam pavements, there is no wonder that a large percentage of laymen entertain the same idea when to them pavement is not a pavement unless constructed in whole or in part of concrete. Before definitely deciding for this type of pavement it is best to carry on a campaign of education among the tax-payers to keep down future dissatisfaction which might result in legislation to prevent construction.

To keep within the program, it was necessary to narrow the width of the streets as the distance from the business center increased, maintaining a twenty-four foot roadway as a minimum on the narrow streets and thirty feet on the wider; narrowing to a sixteen foot paved strip down the center of the road as a connecting link with the county highways in all directions, these strips being constructed with the idea in view of a completed pavement for the full width roadway as future improvements justified.

The undisputed success obtained with bituminous macadam here has fully demonstrated to the writer his theory that a pavement of this kind is the best and most economical to be had for the residence section in the majority of cities of several times the population of this, and he would not hesitate to recommend the construction of such pavement on a concrete base for the business streets of the average town of from ten to fifteen

* City Engineer of Mineral Wells, Texas.



A HEAVY LOAD ON TWO-COURSE ASPHALT MACADAM ON 4-INCH CONCRETE BASE

thousand population, carrying a relatively heavy traffic.

SHOULD BE BUILT ON UNIT BASIS

The fact that penetration bituminous macadam pavements under heavy traffic have not proved economical in many instances, is no doubt because the foundation of such has been too light or improperly designed and the most essential points of construction have been disregarded. A bituminous macadam pavement has a peculiarity all its own in that no rule-of-thumb methods can be adhered to. It should not be constructed by contract at a price per mile, but preferably on a unit basis, and all units presenting like conditions should be constructed as nearly alike as possible.

Especial care should be taken to secure a firm, well-drained foundation and an extra depth of curb in some instances, which will act as cut-off walls, augmented with stone or tile drains if there is a macadam base. Where the pavement is laid parallel and adjacent to the slope of a hill, such construction on the upper side becomes almost essential. The writer has noticed where this was not done that the water found its way underneath the pavement in sufficient quantities to cause an upheaval.

The local pavement was laid on a four-inch compact base using stone passing a 3¼-inch and retained on a 1¼-inch screen. The stone was dumped on the foundation and spread with forks. In only a few instances did a wavey effect result and this possibly would have been eliminated had the stone been spread with shovels. Dust was then placed on this base course and broomed into the voids in visible quantities sufficient to fill them. The writer would note here, however, that cut made in the completed pavement at a later date revealed in some instances a penetration of the asphalt through the base, denoting an inequality of void fillings. This he believes could be eliminated by constructing the base as water-bound macadam, and allowing sufficient time to dry before placing the top course.

The wearing course was constructed in one and two courses. The one-course surface was 1½ inches thick and the two-course was two inches thick. The latter construction was used on such streets as were on a concrete base and the more heavily traveled resident streets. Stone passing a 1¼-inch and retained on a ½-inch screen was used for the wearing surface and after being spread was rolled until thoroughly keyed together before pouring the asphalt.

Excessive rolling should be guarded against as having a tendency to round off the particles, thereby preventing interlocking and crushing the stone to the point where filling of the voids may take place, preventing uniform penetration of the asphalt. If any surface irregularities appear, they should be remedied by removing or adding coarse stone as the case may require.

Asphalt having a petetration of 90 to 100, 100 Gramm weight, at 77 degrees Fahrenheit was used and applied at the rate of 1.75 gallons per square yard for the one-course pavement. Immediately after the application, the pavement was covered with a thin layer of half-inch screenings and was again rolled. Sufficient time having been allowed for the aphalt to cool, the street was thrown open to traffic.

In case of two-course construction, after the first application had been applied a layer of half-inch stone was applied and well rolled into the first course, this in turn being covered with .75 gallons per square yard of the same grade of asphalt as previously used. This was followed by a coat of stone screenings for a cover material, applied as in the one-course construction. The asphalt was heated to a temperature between 275 and 350 degrees Fahrenheit and applied from hand pouring pots having wide spouts. Special care was taken to secure uniformity in the treatment and no overlapping of joints was permitted. The asphalt was poured from the center of the street both ways to the gutter and applied at right angles to the line of traffic.

To secure uniform distribution, it was at first though best to mark off squares or rectangles in which so many pots of asphalt were to be poured. This method proved unsatisfactory, however, due to the fact that it was almost impossible to main-

ONE-COURSE ASPHALT MACADAM ON MACADAM BASE ON FIFTH AVENUE

tain a uniform level in the pots when drawing, and fat and lean places resulted. Satisfactory results were obtained by educating the operators of the pots to guage their pouring by their backward steps, this resulted in almost entire elimination of fat spots, and this method was used through the rest of the contract.

On less prominent business streets the two-course construction was used on a four-inch concrete base. Due to the discovery of oil in this locality within the last three years it so happens that these streets have been subjected to an unusually heavy truck traffic, and this four-inch base has withstood ten-ton and twelve-ton loads without the slightest sign of cracking from this cause. This as a general practice could not well be recommended. The writer does believe, however, that with a heavier base, this pavement will economically withstand heavier traffic and this fact has been demonstrated from the action of the above mentioned streets so subjected, for, though paved in 1915, there has been no money spent on them to date for maintenance, and it does not seem now that it will be necessary. But it might be well this coming spring to apply a seal coat to a few of the streets and if this process is repeated, the cost of which in no event would be more than a few cents a square yard, at intervals of a few yards, the life of this pavement should be prolonged indefinitely.

Mineral Wells to date has a total of 153,000 square yards of pavement, representing eight miles of paved streets, of which 119,000 sq. yds. or seven miles is bituminous macadam. The pavement was laid at a cost of 73c per square yard for one-course on macadam base, 88c for two-course on macadam base, and $1.20 per square yard for two-course on four-inch concrete base.

To date there has been spent less than $1,500 for maintenance, and this was on eight blocks of Southwest Fifth avenue, and four blocks on West Hubbard street, both streets of one-course construction on macadam base. The repair in both instances was made necessary by the heavy traffic previously spoken of. On Fifth avenue a seal coat was applied. The street was broomed and then flushed with fire hose and allowed to dry, and an application of a half-gallon of asphalt per square yard applied, this being covered with half-inch screening and rolled. After about eight months traffic, this street has all the appearances of being sheet asphalt pavement.

On West Hubbard street, which parallels the foot of the mountain, seepage water found its way under the foundation, which gave away completely under constant pounding of heavy traffic and it was deemed best to remove the entire pavement and put in a concrete base after suitable drainage of the type previously mentioned had been provided. This was done more than a year ago and two-course pavement laid on five-inch concrete base. No further complications have resulted since and the pavement has withstood the heaviest traffic.

Numerous openings have been made in our pavements and at first they were repaved by filling the openings with dirt and using the original macadam as base with a cold mixture as a top. After unsuccessful attempts to secure satisfactory results by this method, all excavated materials were removed, the excavation filled with 1:9 concrete mixture to within two inches of finished grade and a two-course construction put on using hot mixture. This result was more than satisfactory and out of more than two hundred openings within the last two years there have been no noticeable effects from wear or settlement. A pavement patched or replaced with materials other than those from which they are constructed presents an unsightly appearance and wears unevenly.

Bituminous macadam pavements are in my opinion the solution to the paving problem for a town with small means. Outside of the asphalt kettles and a roller, the expense for equipment resolves itself into almost nothing.

Gravel Mat on Adobe Subgrade

In portions of the southwest is found an adobe soil which, under the hot sun, contracts so greatly as to form cracks several inches wide. Pavements laid on this soil are frequently found to crack open as the adobe soil shrinks and cracks beneath them and this has given considerable trouble to paving officials in those sections of the country. Some instances of this were described two or three years ago in **Municipal Journal.**

The California Highway Commission found this soil condition in Butte county, California, where they were building a stretch of road eight miles long through a level country, and have taken measures to prevent the wearing surface laid on the adobe subgrade from forming the large cracks so often found under these conditions.

The subgrade is thrown up one foot above the natural elevation and side ditches are dug to secure drainage. The subgrade is then rolled and a 4-inch mat of gravel is placed over it and thoroughly rolled with a 12-ton roller. On this is laid a 6-inch slab of reinforced concrete 18 feet wide. The concrete is mixed 1:2:3. Reinforcing rods are placed across the pavement at 18-inch intervals, 2 inches from the bottom of the slab, and longitudinal reinforcing is placed 3 inches from each edge of the pavement, the rods lapping 18 inches. By use of the gravel mat to prevent adhesion between the concrete and the adobe, and the reinforcing rods, it is hoped to prevent any cracks in the adobe from producing corresponding ones in the concrete above.

Steel Markers for Lincoln Highway

It is reported that before the end of the year an enameled steel marker will have been placed at every turn and cross roads of the Lincoln Highway between New York and San Francisco, wherever their presence would be desirable. It is said that this will be the longest highway in the world with uniform markers. The road from Omaha to San Francisco already has such

markers and they are now being placed between Omaha and New York.

The Lincoln Highway is 3,223 miles long. It has never been permanently marked between New York and Omaha but instead there have been painted markers stencilled on telegraph and telephone poles. It is estimated that the cost of marking the road from New York to Omaha will be about $20,000.

New York Street on Fire

Coal ashes were used for constructing a fill along the line of Corlear Avenue near 240 Street, New York City, and the street thus graded was paved and sidewalks and curbing laid, and a wooden railing placed for protection along each side of the embankment. Recently fire has started in the coal that is mixed with the ashes and for several blocks the street now is emitting gases while the surface is settling in some spots and heaving in others, cracks are opening in the roadbed, and both roadway and sidewalks are thrown out of surface, and in places the wooden railing has caught fire.

It has been suggested that the fire was caused by spontaneous combustion, which is possible, or it may have been caused by fires started by boys along the sides of the embankment setting fire to the coal therein, and the combustion working its way into the interior. Similar fire have occurred before in other cities. Chicago had one burning for several months in the made ground along the lake front, which the fire department was unable to drown out and which, we believe, had to be permitted to burn itself out. This is one of the dangers incurred by making fills with inflammable materials and one which should be borne in mind in disposing of city refuse by dumping.

Renewing Lower Chords of a Highway Draw Span Under Traffic

Expensive and troublesome falsework and by-pass eliminated by provision of temporary bottom chord wooden substitute members; releasing the old members and the new ones during replacment. Trolley car traffic diverted to one side of bridge while opposite truss was repaired.

The draw span of the Washington bridge over the Housantonic river, Connecticut, is symmetrical about the transverse axis, and has two pin-connected trusses 203 feet long and 19 feet 6 inches apart on centres and its wooden floor is carried on floorbeams suspended from the lower chord pins. The lower chord was made of 7-inch channels latticed, which in 1912 were found to be seriously corroded through the whole length, with enlarged pin-holes badly distorted by overstrain, so that the bridge was in danger of collapsing through deadload stresses when swinging.

GENERAL METHOD

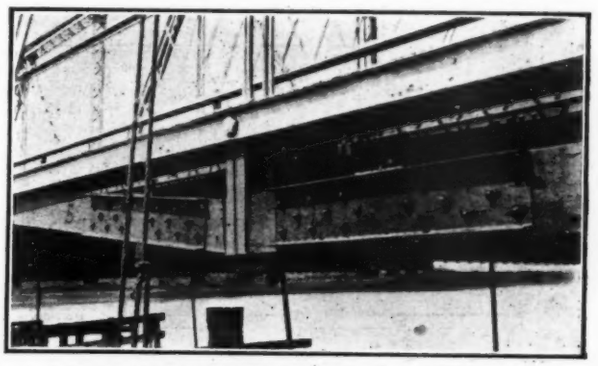
In order to prevent serious interruption either to navigation or highway and street car traffic, Herbert C. Keith, consulting engineer, devised a method of reconstruction which enabled the old bottom chord members to be replaced by new ones by means of a system of temporary adjustable timber substitute members that carried the bottom chord stresses and released the old permanent chords, while the bridge remained in service and was swung as often as required by navigation. The work was successfully executed under the direction of Mr. Keith and subsequently formed the subject of a paper presented by him to the American Society of Civil Engineers and published in the "Transactions."

A careful investigation of the bridge showed that the bottom chords were always subjected to compression stresses whether the bridge was carrying maximum liveloads or was being swung with no liveload. These stresses were calculated and temporary struts, indicated by the broken lines in the elevation diagram, were provided to carry them. They were connected to the permanent structure in such a way as to carry the stresses safely while the lower chords were replaced and were detailed to provide simple and efficient bearings and adjustments.

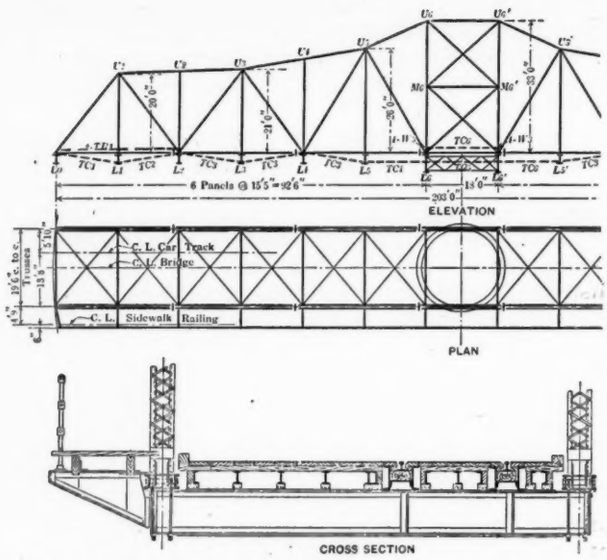
TEMPORARY MEMBERS

These struts were made of wood having at one end, steel plate jaws engaging the lower chord pins, except that the centre panel struts had full cross-sectional bearing transverse to the axis at both ends. The other struts were inclined and were made in sub-panel lengths with transverse bearings slightly inclined to the vertical at the lower ends, where they engaged the floorbeam webs and with steel jaw plates engaging the lower chord pins at the upper ends.

All struts were made in two pieces each, con-



SPLICES AND ADJUSTMENTS OF LOWER CHORD STRUTS



DIAGRAMS OF DRAW SPAN—TEMPORARY MEMBERS SHOWN BY BROKEN LINES

nected by channel iron fish plates bolted on through round holes at one end and slotted holes at the other end to provide for longitudinal elongation and shortening of the member that was produced by the operation of an adjustment wedge bearing on cast-iron caps on the adjacent ends of the strut and operated by screw bolts as shown in the detail. At each end of the bridge the struts were supplemented by tie rods, 2 PR, provided for any possible tensil strain that might be developed. These tension members were made with pairs of adjustable rods connected by yokes to U-bars passing around the chord pins.

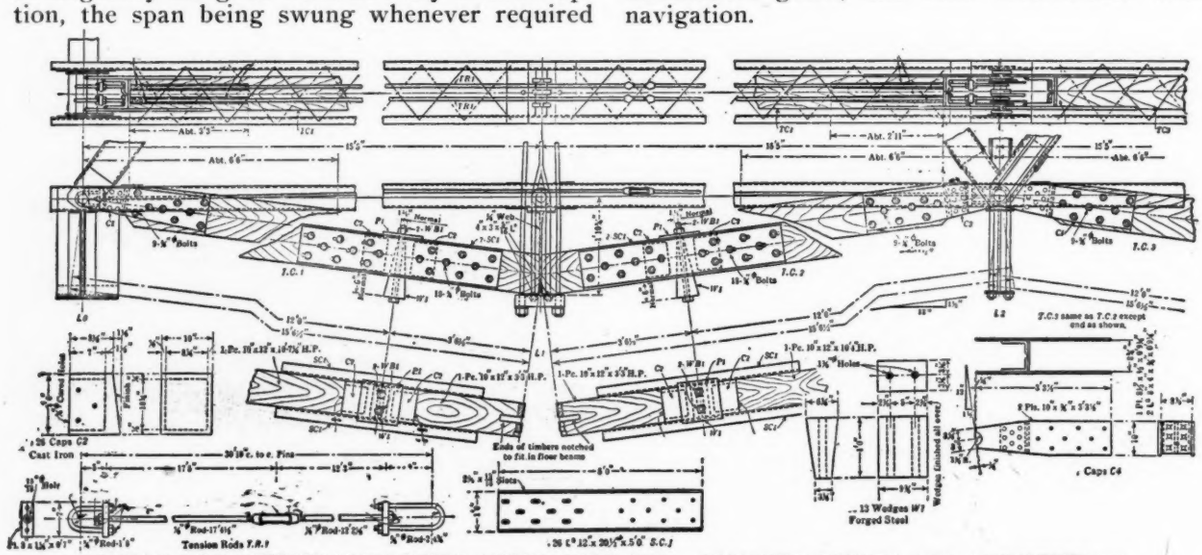
SEQUENCE OF OPERATIONS

It was intended to execute the repairs during the winter season when the river is usually closed to navigation by ice, but the winter proved unusually mild and although navigation was maintained uninterruptedly during the entire period of reconstruction, the work was carried on as originally designed without delay or interruption, the span being swung whenever required without stopping the repair work. At the commencement of operations a barricade was built at each end of the bridge, and a rail was extended the whole length of the span to confine the traffic to the trolley track and highway floor on the south side, while the north side of the centre line was stripped for repairs and the sidewalk floor removed.

The temporary struts were put in place and connected to the permanent structure and the wedge nuts carefully screwed up from the centre of the bridge to both ends, alternate wedges being adjusted by three men with long-handle wrenches turning each nut a small amount while the head of the wedge was struck with a sledge. In this way the stresses were considerably relieved in the centre panels of the old chords before the wedges were adjusted in the end panels.

After suitable tests and inspection showed that the old chords were free from stress, they were removed, beginning at the east end and replacing the old members by the new ones and connecting the latter before the chord in the next panel was disturbed. The splice pieces in the new chords were connected with bolts in half the holes and drift pins in the other half, all of which were replaced by field-driven rivets as soon as convenient after the removal of the temporary struts.

After the bottom chord in the north truss had been renewed, traffic was transferred to the north side of the bridge, the south side was stripped, the struts were transferred to the south truss and the operations repeated. The interruption to the trolley service on the bridge was for about six weeks, during which period the passengers were obliged to walk about 300 feet and vehicular traffic was confined to the half width of the bridge. The total cost of the work, exclusive of engineering expenses and watchmen, was $5,900. The estimated cost of the alternative method of repairs which involved a detour, with temporary viaduct and draw span, and car service was estimated at a minimum of $10,000. This method would have involved a greater distance of travel, undesirable grade, and some interference with navigation.



DETAILS OF TEMPORARY LOWER CHORD TIES AND INCLINED STRUTS AND ADJUSTMENTS

PUBLIC WORKS.

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Profitable Expert Bridge Services

There are few portions of the field of municipal construction and maintenance where expert engineering direction is more necessary than in bridge work, especially for long spans or under heavy traffic. Perhaps there are few places where expert services, not afforded by the permanent staff, are more likely to be omitted or deferred, or where they pay higher dividends of safety and economy. If adequate maintenance, inspection and design of all highway bridge work were properly assured, accidents would be eliminated and the total cost of the structures would be greatly reduced.

These points are convincingly demonstrated by the description on page 275 of the able manner in which an eminent bridge engineer repaired an important unsafe structure with remarkable rapidity and economy. If this structure had been properly inspected and maintained, it would not have been in the perilous condition described, and even the moderate cost of repairs eventually incurred would not have been necessary.

If the final inspection and repairs had not been made by a competent expert, they would undoubtedly have been very much more expensive and might, not improbably, have been executed in a manner that would have jeopardized the safety of the structure or caused very much more inconvenience and interruption to traffic.

The analysis of the problem and appreciation of the difficulties, dangers and possibilities of the case, enabled the experienced engineer to devise a simple and unusual method that, under careful supervision, was executed by reliable workmen previously trained in this class of construction. Like almost every other problem in this field, it could not be solved by merely repeating a previous method, but required special analysis, design and competent workmen under expert supervision.

Bituminous Macadam and Bitiminous Concrete Roads

The city engineer of a Texas city in this issue describes bituminous macadam pavements which have given excellent service under traffic conditions unusually severe for a town of small size, and recommends such pavement for the main traffic streets of small cities.

As the author rightly says, many engineers look with distrust on bituminous macadam (that is, pavement laid by the penetration method) for any except lightly traveled residence streets, and are in the habit of recommending bituminous concrete (materials mixed before laying) on either a concrete base or a heavy and well prepared road of macadam which has seen several years of service; or some engineers admit or even prefer a bituminous concrete base in preference to either of these. In spite of the excellent record made by the Mineral Wells bituminous macadam pavements, we believe that engineers are justified in using bituminous concrete for pavements that will have to meet the demands of heavy traffic. In this case the bitumin-

ous macadam pavement appears to have been well laid, on a base that gives it the best of support. In addition, it has probably been favored by climatic conditions and possibly by others as well.

On the other hand, this experience does seem to teach the lesson that under favorable conditions and when well constructed, a bituminous macadam pavement will carry quite heavy traffic and endure under it for several years; and therefore that where means are limited or for other reasons it seems imperative to cut down the expenditure by the last possible dollar, it would be permissible to lay bituminous macadam if care be taken to insure that the foundation is naturally or artificially kept dry and unyielding and if care and skill be employed conscientiously in the construction of the pavement.

This experience would also seem to offer reasons for a feeling of greater or less confidence that a well laid bituminous macadam pavement on a highway where traffic is increasing very considerably will continue to give service for several years under such traffic if carefully looked after and kept in repair, and that in the anticipation of such traffic it is not imperative that the bituminous macadam be replaced immediately with bituminous concrete, but the highway authorities would be justified in at least testing out the bituminous macadam under the increased traffic and thus possibly be able to defer for a few years the replacing of it with a more durable pavement, thus securing a longer continuation of returns from the previous expenditure.

Private Rights in Underground Waters

About few subjects have more contentions arisen than those connected with the private use of streams and other waters. The right to use a stream flowing over or along the property of the user is generally admitted, but ordinarily with the provision that the water must be returned to the stream for use by riparian owners lower down, such water being practically unimpaired in either quality or quantity. In the western states, where the water is used for irrigation, reduction in quantity is admitted to be necessary. Most of these questions, however, have been settled by the courts so far as ordinary cases and conditions are concerned.

In the matter of ground waters, however, the decisions of the courts have not advanced nearly so far. One reason undoubtedly is the less general use made of such ground waters; another, the difficulty of tracing the ground water from one place to another and proving the effect of acts at one point upon the quality or quantity of the ground water at another point. Except for such powers as are possessed by Boards of Health, we do not recall any decisions of importance bearing upon the pollution of underground waters, as by the use of leaching cesspools or the turning of other impurities into the ground above a water-bearing stratum. And yet, as underground waters are used quite generally for public water supplies, we see no reason why there should not be as serious an injury to the users of such waters by polluting them by the discharge of sewage and other impurities on to the soil in such a way that the foul water can reach the underground flow, as there is by polluting surface streams.

However, the courts have held, in some instances at least, that no one has a right to use underground water to such an extent as to deprive others of their share of use of the same water. For instance, it having been proved that a city, by pumping underground water for its water supply, has so lowered the water table or the hyraulic gradient of the underground supply as to dry up the wells of those who have formerly depended upon such underground water, the courts have held that the city must discontinue this practice or else pay damages to the well owners, or both. A recent illustration of a contest in the courts involving this principle is referred to in this issue, the city of Ann Arbor, Michigan, being sued by a number of farmers for so lowering the ground water by pumping for the city supply that the farmers find it impossible to obtain water for the use necessary to their domestic and agricultural needs.

Municipal Contracts in Philadelphia

In spite of the many reasons for holding back on public work which have influenced cities and states this year, the city of Philadelphia has already let contracts for municipal work which total $19,348,266. Contracts for the whole of last year totalled only $18,127,997. Of this year's contracts, over 12½ millions will be paid from the general fund and about $700,000 from loan funds. The totals for both years include contracts by the Bureau of Street Cleaning.

Sturdy Concrete Mixers

At a recent fire at Wilson Dam, Mussel Shoals, Tenn., the wooden trestle at the cement shed was burned causing two 48,800-pound Smith concrete mixers to fall approximately 60 feet.

Their construction was so sturdy that they sustained relatively small damage from the heat of the fire and the impact of the fall. Practically no castings were broken, all the gears except the bevelled gears were uninjured, and only 3 teeth of the main gear rings were smashed. Their condition was so good that they only required minor repairs which are being made with the expectation of putting the mixers soon into service again.

These machines, which have for several years been in government service, are two of the six largest concrete mixers ever built, each having a capacity of 112 cubic feet of mixed material or 168 cubic feet of loose material. They are mounted on steel skids and are equipped with gated batch hoppers, power tilting device and friction clutch pulleys. The rapid discharge of the whole batch of concrete by tilting the mixer while it is revolving enables the crew to increase the product by an estimated amount of 150 to 200 cubic yards per day more than could be obtained on a non-tilting mixer.

Designing Aqueduct of Winnipeg Water Works*

By James H. Fuertes

Protecting concrete from alkali; designing and constructing overflows, blow-offs, culverts and miscellaneous small works.

PROTECTION OF AQUEDUCT

The remedy adopted for this trouble was thorough drainage of the soil to prevent the concentration of the salts locally. The whole aqueduct from mile 17 eastward to Shoal lake, and the pipe lines from Mile 13 westward to Winnipeg, are protected in this regard. The 4 miles from mile 13 to mile 17, which is an 8 foot diameter section with very thick walls, built in place, depressed so low below the prairie that drainage could not be had for the bottom of the trench to any nearby watercourse, and which was the first pressure pipe to be built on the aqueduct, was underdrained. By an accident of chance, the excavation was made when the soil was relatively dry so that the invert could be trimmed exactly to fit the concrete, in the dry, and hence the underdrains leading to sumps that would have been required had the trench been wet were not put in, and no way exists to drain the soil here without an expensive construction program.

Also, it was assumed that the use of dense, hard concrete, carefully placed and with a smooth surface, would resist the disintegrating of the soil if the surface waters were properly taken care of, so that there would be no further concentration of the salts locally; and that the actions, if any, would be limited, and gradually disappear before damage worthy of attention could be done, by the leaching out of the soil. Along parts of the line, however, in this four miles, examinations of the pipe that had been in the ground two years showed, in places, a limited softening of the concrete on the surface, when the surface was porous; not continuous, as to areas attacked.

Plans have been perfected to underdrain this work and to make, at intervals, wells to the underlying gravel, into which the ground water and water collecting in the trench may be allowed to drain, as and when it may.

REINFORCED CONCRETE PRESSURE PIPES

The premoulded reinforced concrete pipes from Deacon to the reservoir in Winnipeg were built by the Canadian Lock Joint Pipe Company, under general specifications prepared by the District.

The 5-foot 6-inch diameter pipe from Deacon to Red river, 49,900 feet long, was built for and tested in one length to the full head caused by the water in Deacon reservoir (proposed) with the water shut-off at the Red river, plus a few feet for mild surging. The limit of leakage allowed by the specifications under the above head was at the rate of 115,000 Imp. gallons per 24 hours for the 49,900 lin. feet. The actual test showed a safe margin below the requirements.

The 48-inch diameter pipe, from Red river to McPhillips St. reservoir, 11,400 lineal feet, was built for and tested as a unit, after laying, to a pressure of 40 pounds per square inch. The limit of leakage allowed by the specifications was 9,000 gallons per mile per day, and there was, as with the larger pipe, a safe margin below the specified limit.

The pipe was built at Transcoma, shipped to the trench and laid by special machinery and methods. The joints were all provided with crimped copper strips as water cut-offs, every 8 feet for the 5-foot 6-inch pipe and every 10 feet for the 48-inch. The methods of manufacture, transportation and laying of this pipe were so well worked out and under control that of the total length of 61,300 feet manufactured, barring the three lengths of 5-foot 6 inch pipe made for experimental purposes by the District, one broken in loading and one purposely broken by pressure (in testing), there were two culls on the 5-foot 6-inch pipe and two on the 48-inch pipe.

DESIGNS FOR SPECIAL STRUCTURES: OVERFLOWS AND BLOW-OFFS

Mention has hereinbefore been made of the use of overflows at all the imporant river crossings to prevent accidents to the arch section by careless operation of the gates at the Intake. The illustrations give a plan and section of the overflow at Boggy river, which may be taken as typical.

The main features of these structures are the provision of ample overflow facilities; a blow-out valve; stoplogs to block or regulate the depth of flow in the aqueduct; a boat entrance for taking out boats used for inspection and floating down stream from the next entrance up stream; an overflow channel to the river, arranged in such manner as to exclude the cold outside air from the interior of the aqueduct and remain open at all times for the discharge of the overflowing water; provisions for balancing the air pressures in the aqueduct, due to changing depths of flow, etc., and a house covering the aqueduct where the overflow is located.

CULVERTS UNDER THE AQUEDUCT

To take care of surface drainage crossing the line of the aqueduct, culverts of different sizes were required at various points. Without exception, except at the major river crossings, surface drainage is taken under the aqueduct, owing to the elevation of the grade line relative to the ground surface, in an inverted siphon. The details of these structures, shown in general by the plan and section, are similar in all cases, varying only in size or details to adapt them to various locations.

The form adopted allows of cleaning these out, if necessary, from time to time, and provides frost proofing for all parts except the open mouths, which are so designed as to be easily freed from ice forming there in very cold weather. The outlet and inlet ends are provided with stoplog

*Continued from page 259.

grooves to permit blocking out the water for cleaning or removing ice, and have heavy chains hung across the entrance to keep out wandering animals, such as bear, moose, and caribou, as well as cattle in the few localities where there are any running loose in the woods.

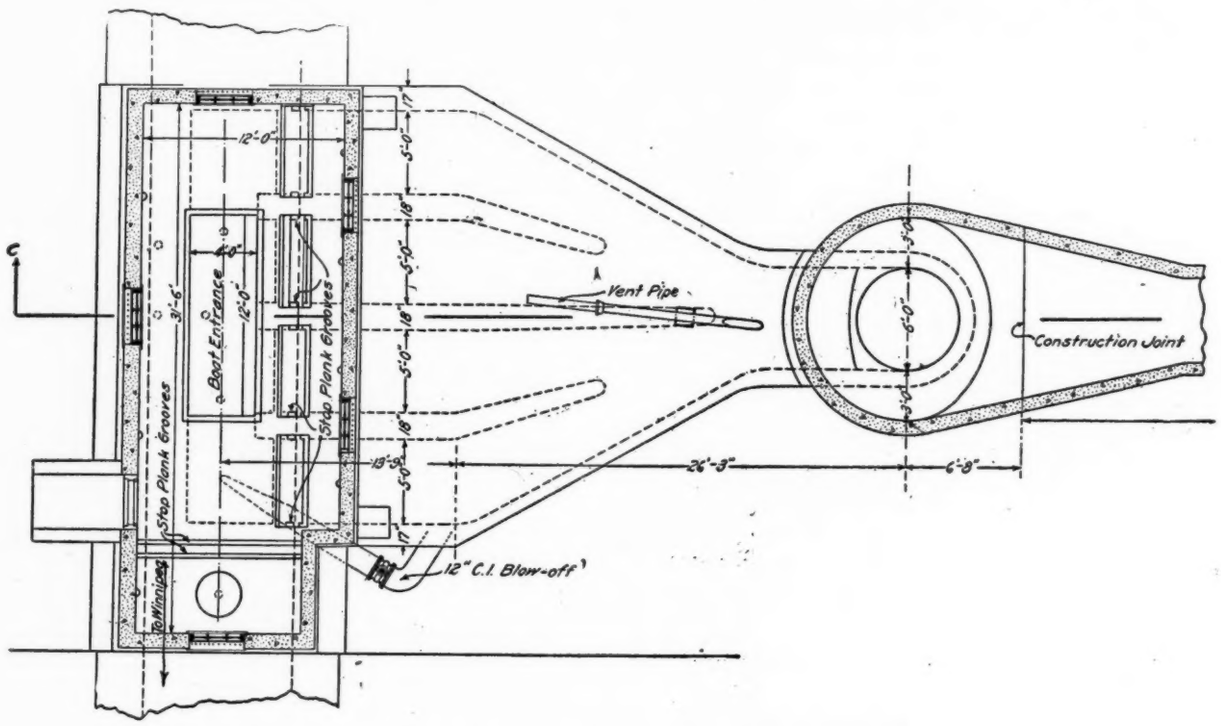
The top of the conduit, where it passes under the aqueduct, is placed lower than the bottom of the outlet ditch to seal out the cold air which might, if entering, cause trouble with the aqueduct invert. On this drawing is also shown the method of passing the aqueduct over the culvert to prevent settlement and to secure permanence.

MISCELLANEOUS SMALL WORKS

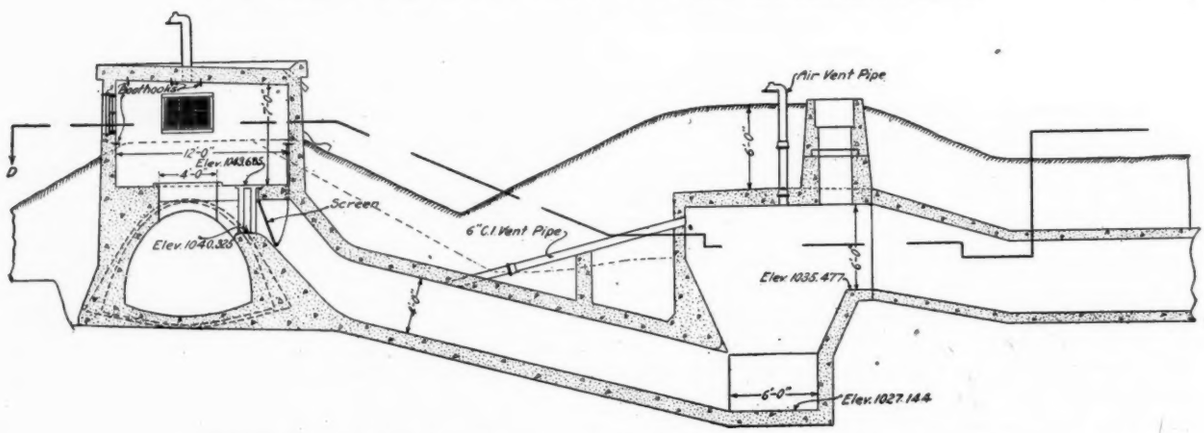
Mention, merely, is necessary of the provisions for air valves on the closed pipe lines, and air vents for the valve chambers and other structures where great cold might work damage to the valve, etc., housed therein. In some places, notably on the 5-foot 6-inch concrete pipe line, special vents were devised consisting of a vent pipe with the lower end immersed slightly in a shallow pan of non-volatile oil, an expedient which would permit maintaining equilibrium of pressure without free circulation of the cold air.

CONCLUSION

The word of caution incorporated in the report of Hering, Stearns and Fuertes that "The cost of the work will also depend, to a great extent, on the skill exercised in the final location of the line and the establishment of the grades in a proper manner. A margin of half a million dollars, or more, may easily be used up by failure to appreciate the elements in which economies may be practiced," can be appreciated by mention of the fact that, had the arches and inverts been



OVERFLOW AND BLOW-OFF AT BOGGY RIVER—SECTIONAL PLAN DD



OVERFLOW AND BLOW-OFF AT BOGGY RIVER—LONGITUDINAL SECTION CC

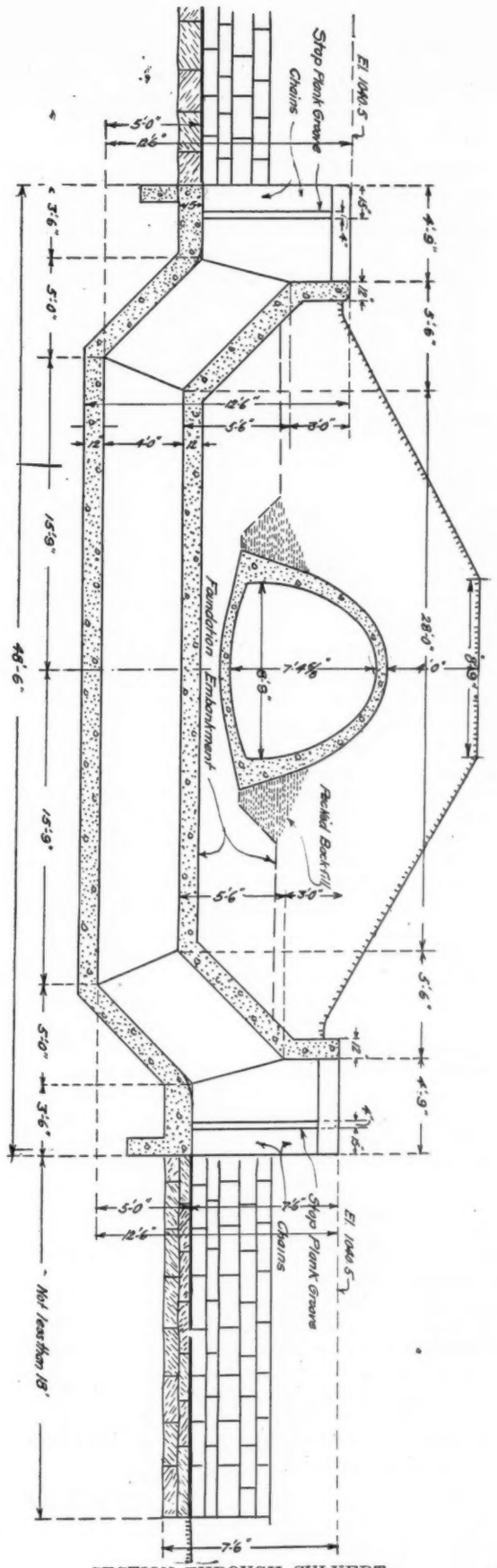
made but one inch thicker than they were, there would have been required some 35,000 yards of concrete extra at a total extra cost of approximately $500,000.

There was, therefore, no margin for "slap-dash" methods of designing; all things had to be considered with great care to prevent extravagence. The basis of design had to be so sound that the actual works could be pared down to the narrowest margin of excess possible, or the money would vanish in half-million dollar blocks for every extra dollar per foot the work cost.

It is worthy of note, now that the aqueduct has been completed and is in its second season of operation, that all of the portions of the 1915 work that suffered settlement cracks, when the backfill was placed on them, are still in place and in use, having been repaired as above described; and that the aqueduct, owing to the smoothness of its interior surfaces and the excellence of the finish as to lines, grades and uniformity throughout, will, despite predictions to the contrary and despite the cracks, not one half of which were repaired at all, deliver in its present condition more water than the conservative capacity assigned to the scheme in the Hering, Stearns, Fuertes report.

Further, the total cost of the construction features of the whole proposition has not exceeded, including the construction railway and all extra work and repairs, the original estimates of Hering, Stearns and Fuertes; the allowances that were made in those estimates to cover extra foundation costs, ditching, swamp drainage, the construction railway and equipment, the probable extra quantities of concrete, excavation, steel for reinforcement, difficulties at stream crossings, and other elements difficult to foresee, having proved sufficient to cover just such contingencies as were encountered.

Further, also, these exceptionally fine results were achieved in spite of war conditions, the plans for the aqueduct having been completed early in 1914, and the construction of the railway well advanced before the war broke out; and the water of Shoal lake was delivered into the Winnipeg reservoir in the Spring of 1919. But for the fear, locally, of trouble with steam boilers and heating plants as a result of changing suddenly from a very hard to a soft water in the midst of cold weather, the new water could have been made available in the winter of 1918, so far as the aqueduct and pipe lines were concerned.



Fire Hydrants in Harrisburg

During the year 1919 automobiles caused accidents to nine fire hydrants of the Harrisburg, (Pa.) water department, it being found necessary to replace three of them.

Twelve hydrants were dug up and the roots of trees removed from the drip holes, and twenty other hydrants were repaired in their drip riggings and valves.

All hydrants were blown out twice during the year, oiled, in many instances packed, chains gone over and nozzles repaired.

Bull Run Water for Portland, Oregon

By Chas. W. Geiger

Water dammed up in natural lake reaches city's reservoir through underground passage whose existance was not known with certainty.

More than two billion gallons has been added to Portland's water storage by the construction of a dam at the moderate cost of $39,000, and the ultilization of a suspected but unproved underground water channel as part of the supply conduit. Portland first experienced a water shortage a few years ago, when the consumption became as great as the natural flow of Bull Run river (the source of supply of the city) and on hot days exceed this. During the past two or three years the shortage of water has been giving great concern to the water works officials and inconvenience to the citizens.

Bull Run river emerges from the rocks in a canyon, but the exact source of the supply has never been demonstrated. It has always been considered, however, that Bull Run lake was the source of the river, this lake being about a mile from where the river rises and having no surface outlet. About two years ago the water works officials decided to act on the assumption that this lake fed the river and to build a dam which would so raise the lake as to supply sufficient storage to prevent overflowing of the lake during winter months, storing this amount for use the following summer. A temporary dam was built which held the lake about 10 feet higher than normal during the summer months. The water bureau then built below this a second dam with a gate by means of which the stored water could be let out of the lake as needed, this being built at a point where it was supposed that the discharge of the lake through it would reach a sump which communicated with the outlet in the canyon where Bull Run river originated. When the second dam had been completed, the first dam was blown up and the water was held by the second dam. In order to test the correctness of the assumption that this sump communicated with Bull Run river, the gate was opened and several million gallons of water released and entered the sump. In a few minutes the flow in Bull Run river, where it arose in the canyon, increased until there was no longer any question about the connection between it and the sump by way of an underground passage. This results, as stated, in adding two billion gallons of water to the city's supply.

The success of this project means that the city will now drop proposals for the construction of additional reservoirs. The natural reservoir formed by this dam stores this water under almost ideal conditions and by means of telephone it is possible for attendants at the headworks to have the flow in Bull Run river increased as needed. To have met the shortage promblem by means of artifical reservoirs, to store the flood waters of winter and spring to tide over the summer shortage, would have meant an investment of between three million and four million dollars.

Work on constructing the dams in Rull Run lake was started about two years ago under the direction of Mayor Baker and the City Council, the plan originating with City Commissioner Mann and the engineering work being done by Ben Morrow, Fred Dandlett and Charles Oliver, engineers of the Water Bureau. Execution of the work was slow and difficult for the reason that all supplies and materials had to be taken tc the lake, a distance of twelve miles, on pack horses. It was impossible to take in any heavy machinery and the work was largely hand work, even to the cutting of the lumber. The labor on the job was performed largely by students of the University of Oregon Argicultural College, who took the jobs during the summer vacation.

Railroad Congestion Prevents Filter Completion

A number of cities are finding difficulty in furnishing safe water to their citizens because of the refusal of the railroads to transport chemicals needed by the purification plants, but Toledo, Ohio, finds the railroad congestion interfering in still another way with the purification of its water. It has under construction 22 filter beds which will be completed about October 1st so far as the masonry is concerned, but so far the city has been unable to get filter sand with which to fill them, without which they, of course, are absolutely useless. An order for the sand was given to the companies furnishing it about the first of the year but they have been unable to get the railroads to deliver it.

The new filters will add 22 million gallons a day to the capacity of the plant, which is now 36 million gallons, and will greatly relieve the water situation. All of the capacity of the present filter is being used and if this summer had not been an unusually wet one there would have been a shortage. A considerable part of the capacity of the new filters is needed, therefore, to insure against a shortage which would be caused by any demands for amounts out of the ordinary.

Ann Arbor Sued for Lowering Ground Work

The city of Ann Arbor, Michigan, has been securing its water supply from underground sources and suit has recently been brought against it bv farmers in Washtenaw county to recover $200,000 damages which the farmers claim they have suffered through the lowering of the ground water and to enjoin the city from further pumping of the ground water supply. Seventeen owners have joined in the suit and ask that the city be enjoined from pumping any

more water until the ground water in their farms shall have returned to its natural level, and that the city be permanently enjoined from withdrawing ground water in such quantities as to in any way lower the level of the underground water on their farms.

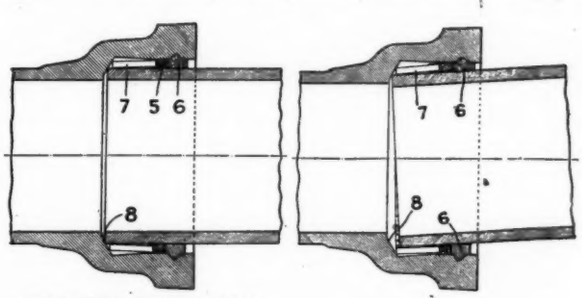
New Idea in Cast Iron Pipe Joints

Pipes sent from the foundry with the hemp and lead already in place, requiring only the calking of the lead after the spigot has been entered.

A new idea in the making of lead joints in cast-iron pipe to be used for water mains, gas mains or other purposes is now being turned out by one of the cast-iron pipe manufacturers. The joint when completed is practically the lead joint on top of hemp packing which has been in use for years. The new feature lies in the fact that the hemp is calked in place and the lead poured before the pipe has been shipped from the foundry. The pipes are made without any bead on the spigot end and the prepared joint is constructed at the foundry a very little larger than the outside of the spigot end of the pipe. The pipes are placed together in the trench, the spigot being sent all the way home in the bell, and the lead joint is then calked in the usual way.

This does away with the necessity of melting and pouring the lead on the work, including the difficulty of pouring in a wet trench. An additional advantage claimed, and apparently with justice, is that this secures a better centering of the spigot in the socket, giving a truer alignment of the interior of the pipe and thus reducing friction of flow in the mains; this being secured by the fact that the lead joint already in place was mechanically centered when poured and thus brings the bell end into the correct position automatically.

In this joint the lead is of uniform thickness around the entire circumference, thus eleminating the danger of too great thickness of the lead ring where the yarn had not been calked in properly. In addition, it expedites the work of pipe laying and reduces the length of time the trench must be kept open.



SPIGOT ENTERED AND JOINT CALKED
5 Hemp. 6 lead.
7 Wedges. 8 Beveled shoulder

JOINT DEFLECTED.
Note How Wedges Have Moved.

In making the joint at the foundry, the pipe is stood on end with the bell uppermost. A short mandrel is inserted in the bell, and a band of iron wedges is dropped into the bottom of the annular bell space, occupying about half the depth of the bell. These wedges, with their connecting strip on top, form an anvil against which the hemp is calked. On top of this is inserted a length of square braided hemp cut to exactly the right length, which is calked into place, and on this another length breaking joint with the first This is calked into place by means of a gland instead of a calking iron, and the lead is then poured. The led is not caulked, but, when it has cooled, the mandrel is removed. In order to protect the joint from injury during the handling of the pipe, a concrete ring plug is inserted in the bell. When the pipe is laid, this concrete plug is removed. As previously stated, there is no bead on the spigot end of the pipe, so that there is no difficulty in inserting it in a prepared joint. The lead is then calked, beginning at the bottom and going lightly around the entire circumference so as not to drive the spigot out of the center, then calking the entire joint until the lead has been driven about three-eighths of an inch below the face of the bell.

Another feature of the joint is the slope given to the bottom of the socket, which comes into play if the pipe is deflected, as when laid on a curve. When such deflection takes place, it is the theory that the extreme spigot end of the pipe slides down the beveled shoulder on the inside of the curve and the wedges (at 7 in the illustration) are free to follow it, thus relieving the pressure on the lead ring at this point. On the other hand, the wedges on the outside of the curve are forced forward by the pipe and thus put extra pressure on the lead at this point and expand it, while the lead on the inside of the curve is compressed; the tendency being to keep the joint tight throughout the circumference. The accompanying illustrations show the joint when laid with the pipe straight and also when deflected.

Water Shortage in Kinston, N. C.

Kinston, N. C., has several times recently found itself practically without water, the reservoir having been emptied. The supply is obtained from eleven wells about 400 feet deep, but the increase in consumption has reached the point where their capacity is exceeded and work has been started on one of several new wells which are to be added. The pumping station is only 150 yards from the Neuse river, but the city authorities will not consider using the river water until the water demand becomes so great as to make the well supply impracticable.

Decatur's Water Shortage

In spite of the construction of the temporary dam for affording a slight storage of river water, Decatur, Iowa, is still threatened with a water

shortage and Commissioner Ruthraff has appealed to the consumers to reduce the consumption as much as possible. He states that unless the consumers co-operate seriously, many factories will have to shut down, but if no water is wasted it will be possible to get along without such drastic steps. There are 8,000 meters on the services, but even these have not induced the economy in use of water that is necessary to avoid the threatened shortage.

Municipal Milk for Jamestown

By Paul A. Davis

The taxpayers have voted to erect a municipal central milk plant, and pasteurize, bottle and distribute milk at a lower price than is charged by dealers.

By a majority of 115 votes the taxpayers of the city of Jamestown, New York, in a special election held August 21st, decided to extend the credit of the city in the sum of $150,000 to enable the municipality to enter the milk business.

The proposition is to erect a central milk plant, equip it with modern milk machinery necessary to pasteurize it and bottle it under sanitary conditions, and to distribute at the doors of the consumers the 18,000 quarts used daily. The sum realized from the bonds will be used to erect the plant and equip it and start it in operation. The bonded indebtedness will be paid off at the rate of $5,000 a year, this and the interest being obtained from the revenue derived by operating the plant.

This is believed to be the first venture of its kind ever made by an American city, and falls into line with the recommendations made by the milk commission that was named by Governor Alfred Smith to investigate the milk situation in New York State. It will undoubtedly be watched with interest not only in New York state but by the country at large.

Mayor Samuel A. Carlson, who advocated municipal ownership of water and lighting plants, city hospital and city market, the operation of which by the city of Jamestown has proved successful, has fought for the city milk plant during the past ten years. In February, 1919, this proposition was voted down by a vote of almost 2 to 1 against it, the total votes cast being 1,954. In the election just held, 2,185 votes were cast, showing much interest in the question and remarkable change in sentiment.

When the recent election was proposed, Mayor Carlson named a publicity committee with Frank O. Anderson, a prominent manufacturer and member of the water and lighting commission, at its head. An investigation by a federal grand jury of an increase of 3 cents per quart made in the price of milk about this time, based on a 1 cent increase paid to the producer, seems to have had an effect in changing the sentiment of the public. At this time the dealers were told to bring their price down 2 cents, to 13 cents a quart, or face an indictment for violation of the Lever act.

The city proposes to reduce the cost of milk to the consumer by an elimination of the duplication of time and effort in distributing the supply. In place of ten milk peddlers passing over the same street each morning, the city will have one peddler go over that street, the city being mapped into districts with one peddler to cover each.

Milk will be purchased from the producers under the contract system, thus safeguarding the milk supply coming to the city. At present it is endangered because of the increasing number of milk condensaries in that section of the state, which by the contract system, provide the dairymen with a steady market for all the milk they can supply. Only clean and sanitary milk will be accepted by the city and this will be pasteurized before being handled and the bottles will be thoroughly cleansed. The orginating of this plan some ten years ago was caused by the impure milk which had been delivered from time to time and the recommendation of the Board of Health to the city council that such a proposition be submitted to the vote of the people.

The plant is to be erected on property already owned by the city and upon which the city hospital now stands. It will be controlled by a commission of four, two of them to be members of the board of health, including the mayor. Each of Jamestown's municipal enterprises is run in this way by commissioners composed of business men who give their time to it in a public spirited manner.

Rapid Hydraulic Fill

Rapid progress is now being made in constructing the Englewood dam in the Miami Conservancy District, by the hydraulic fill process. In one 10-hour shift, July 15, 4,888 cubic yards of material was pumped from the hog trough to the top of the embankment, beating the previous record of 4,600 cubic yards in one shift.

The material is excavated by two large dragline machines that deliver to 7-car trains, in which it is hauled to the hog-box, where it is broken up and washed to the sump by two powerful monitors, screened, and delivered to the dam by two 15-inch centrifugal pumps as described on page 391 of PUBLIC WORKS, May 8th. The efficiency and economy of this work is evident from a consideration of the simple plant and the very small force of men comprised in the dragline, dump car, and pump house gangs that are required for its excavation and transportation, and the continuity with which so large a volume of material is kept moving with little or no hand labor.

Consulting Engineers' Libraries

By Ruth Canovan*

A privately owned libary is an asset to the Consulting Engineer if properly selected, catalogued and used.

The function of a library is two-fold—to accumulate literature and to impart knowledge. In depository of musty, dusty books, but a live information bureau.
other words, the library should not be a mere

To the consulting engineer a privately maintained library is essentially a time-saver. In it the members of his staff can look up references and make searches without taking the time to go to other libraries. They can accomplish this more quickly than if turned adrift among unfamiliar bookshelves. Their librarian understands their problems and knows the library's resources. He also is a time-saver. If they ask for something on water hammer, for instance, they won't have thrust upon them a bulletin describing pneumatic hammers, nor be given "Ganot's Physics" when they want something on inverted siphons. He is himself a specialist, familiar with the work of the firm, its difficulties and demands.

Particularly to the younger men on the force, such a library is of immense assistance. Lacking the practical experience of their superiors and uninformed as to precedent, they need to have at hand published records of past practice and of present-day principles, to aid them in their work. Easy access to such literature stimulates better design and affords short-cuts toward the solution of their problems. It is not enough that such material may be available in neighboring libraries. The engineer cannot waste time in ascertaining where the desired information can be procured, nor in ferreting it out in unfamiliar "diggings." He wants to do his burrowing in his own backyard. Otherwise he'll neglect to do it.

In addition to the time-saving element of the private library is the advantage that there is no restriction as to the length of time a book may be retained, whereas with borrowed books there is always an obligation, either moral or acutal, to return the book within a specified time.

The books in the engineer's own library, moreover, may be freely marked and annotated. References may be added, and marginal notes, which make the volumes more valuable for practical use. Passages may be checked for coyping, plates temporarily removed for blue printing, and diagrams traced,—all without fear of reproach.

These books in the library of the consulting engineer, should include above all, of course, publications which are not apt to be available in the neighboring libraries, such as reports of departments, commissions and experts. They should also include text books and handbooks, which afford technical knowledge in concise form. In such a library there should be certainly one good comprehensive index of engineering literature, such as "Industrial Arts Index" or "Engineering Index"; and such general reference books as dictionaries, directories, atlases, etc.

In order to keep in touch with the best and most up-to-date practice in his profession the engineer subscribes to several of the leading engineering periodicals, which his librarian either clips, or has bound. He is also a member of various professional societies the publications of which he needs to have on hand for reference.

In connection with his recommendations for construction work a file of specifications is useful, and in making estimates, specifying equipment, etc., trade catalogues are necessary, from which types, sizes and prices can be obtained. These also are of service to the engineer who makes valuations.

Then there is the problem of the pamphlet. First of all is it worth keeping? If so, will it be most valuable in separate form or shall it be bound? What form of binding will be most economical and practical?

In addition to the material which it is desirable to have on hand for reference, is that which the engineer acquires in making his reports. There is the file of reports to clients, which must be kept up and indexed; there are vast sheaves of computations and basic data, to be intelligently assembled, bound and filed; there are original drawings, blue prints, maps and photographs, not to mention negatives, lantern slides, etc. Then there is the file of reprints of his own professional papers, which must be kept fresh for distribution, and of which he probably wishes to have one set kept complete for his personal use.

To adequately care for all of this material—stow it away systematically, catalogue it intelligently, and above all, by discarding the non-essential, keep it within practical bounds, a capable librarian is necessary. In the interests of efficiency this librarian should not be asked to devote himself exclusively to filing and cataloguing. He should be called upon also to make searches through the literature, prepare lists of references, bibliographies, etc., thus becoming familar with the contents of the volumes which he indexes. This will not only give him a comprehensive grasp of the resources available in his library, but will arouse his interest in the subjects in which the firm specializes and enable him to intelligently help those who consult him or who send to the library for material.

The one in charge of such a library should be encouraged, also, to join the local library association, as this will bring him into touch with other librarians. Through them he will learn the resources of neighboring libraries and will effect an exchange of courtesies which sometimes includes borrowing privileges not generally extended.

A well chosen library, well maintained, is not only an educational stimulus to the consulting engineer and his staff, but a practical asset.

*Librarian with Metcalf & Eddy, 14 Beacon Street, Boston, Mass.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Grading 15 Miles of Highway

Excavating and transporting 120,00 yards of fine sand with short hauls over low grades

Dear Sir:

Kindly advise me as to what would be the best method for grading a highway where the excavation runs about 8,000 cubic yards to the mile; the haul is from 100 feet to ¼ mile; the material is sand, a very fine sand that it is nearly impossible for autos to go through; the grade on the finished road will be from 00 to 5 per cent; there is not much overhaul, that is haul in excess of 500 feet; the total length of the job is 15 miles.

Yours very truly,

O. J. LIDBERG.,
Grand Rapids, Minn.

The data given are not adequate to determine what is certainly the best or most satisfactory method of making the excavation which amounts to a total of 120,000 yards with an average haul of perhaps 300 feet or more. The most suitable plant, its installation and method of operation depend on several important factors, the principal ones being the topography and drainage, the maximum, minimum and average depth and length of cut, the time limit, if any, for executing the work, the co-ordination, if any, between the grading and the construction of the permanent roadbed of pavement, and the amount and the character of the excavating and transporting equipment that is on hand or most easily available.

The only way in which the methods and equipment for work of this magnitude can be determined is by making approximate comparative estimates of the total costs of executing the work by each of several general methods or by combinations of them, selecting such as will, under the required conditions give the lowest final cost allowing for purchase, rental, maintenance, deterioration, and salvage of equipment in addition to the cost of supplies, labor, superintendence, insurance, interest, and other items of overhead charges which are of great importance especially on a job of this magnitude and may easily make the difference between profit and loss.

In general, fine, dry, loose sand without rocks, boulders or hard strata, and with a moderately level surface, can be easily excavated and transported by several standard methods and appliances suited to different amounts of excavation, depth of cut and length of haul, and it is probable that in a 15 mile length of road several methods can be advantageously employed for light and deep cuts, large and small masses and long and short hauls.

SCRAPER WORK

For every shallow excavation, and where the spoil has to be hauled only 100 or 200 feet, particularly if it is to be deposited in an adjacent fill forming part of the same road, the work can be done by wheel scrapers hauled by teams or tractors.

If the length of haul is greater, as in the case of a longer cut or more remote fill, the spoil should not be transported by the scraper. The scraper may, however, sometimes be advantageously used for loading trucks or cars, the latter being spotted in a depressed roadway allowing the scraper to deliver the sand on a bridge or platform above that contains a trap or rack through which it falls into the vehicle.

The same result can be obtained sometimes by the use of a movable short inclined plane with a timber frame work which can be dragged along the surface of the ground to any required point. The loaded scraper is hauled to the top of the incline by a rope running over the sheave at the summit and operated by an extra team or a hoisting engine. When the scraper arrives at the top it is automatically dumped into the wagon or car, released and returning, to the foot of the incline.

ELEVATING GRADERS

Elevating grader machines, of which there are several types on the market, may be drawn by teams or preferably by tractors, and excavate the loose soil, elevate it by continuous process mechanism and deliver it in an uninterrupted stream to wagons, trucks or cars moving alongside parallel with the grader and at the same speed.

Whatever method of excavation is adopted the length of haul should be kept to a minimum. If made by teams, hauls about 500 feet are large enough. For automobile trucks with dump bodies or dump cars of large or small size operated on standard gauge or industrial tracks the maximum hauls can be made.

STEAM SHOVELS

Whenever the cut is deep or there is a large amount of material to be removed at one place

the excavation can generally be done most rapidly and economically by steam shovels. For a cut 2 feet or more in depth, almost any moderate size revolving steam shovel should do satisfactory work. If the cut is only 4 to 6 inches in depth, provided it has large dimensions and is continuous, it can be handled rapidly by a light revolving shovel with a skimmer type bucket that can be operated with great accuracy to trim the ground close to the required grade.

Under favorable circumstances and where the cut has a depth of several feet, a good steam shovel can excavate from 1,000 to 2,000 yards per day at a cost involving only the shovel charge, fuel and labor of a crew. This does not however, include the removal of the material excavated which may cost as much or more than the excavation.

Unless the sand is uniformly very dense and hard, permitting the shovel to be operated on wide-face traction wheels, it should be mounted on caterpillar traction which will enable it to travel along the line and over irregular surface and soft places under its own power without the delay or expense of providing track, platforms or pads and will thus greatly expedite the work.

TRANSPORTING SPOIL

The first requisite for successful steam shovel work is the removal of the spoil as fast as it is excavated. This can be done in different ways. It can be hauled by teams but a large number of them are required that are almost certain to get in each others way, requiring considerable space for turning and are likely to waste time in loading unless each wagon carries exactly one bucket full of sand.

Motor trucks of 1 to 5 yards capacity are much more rapid, efficient and economical than teams under ordinary circumstances. If the trucks are of more than 5 yards capacity they are likely to be too heavily loaded for the soft ground. They should be provided with quick operating dump devices that are not likely to get out of order and are as nearly automatic as possible, operating principally by gravity. One-yard steel buckets with inclined sides and cylindrical bottoms are very satisfactory when mounted with cradles on the truck platform that enable them to be tilted and discharge their contents quickly and completely by gravity after which the empty bucket is easily revolved back to position by hand. These buckets can be mounted on horse drawn trucks or, when provided with bails are suitable for handling concrete, aggregate, and for general construction purposes.

SERVICE TRACKS

The spoil can be hauled long distances most cheaply in side dump cars of 1 to 12 yards capacity on standard or narrow gauge tracks.

Industrial tracks with very light rails and attached ties assembled in sections, can be very easily laid and shifted to provide for small dump cars runing from the steam shovel to the fill or spoil bank. When they are used care should be taken in arranging the work so that wherever possible the loaded cars run down-grade. This may enable them to be delivered by gravity and hauled back by teams or even sometimes pushed by hand. If a regular railroad track is laid either standard or narrow gauge larger cars can be used on it and more care is justified in its grade and alignment. A down-grade for loading the cars is equally desirable but not so easily secured over the longer hauls that may be made on these tracks.

In all cases provision must be made for handling both full and empty cars with loops or switches at the end of the track, and with provision for a constant delivery and removal of cars at the steam shovel so as to permit its uninterrupted operation without waiting for empty cars or the removal of full ones, a point which is of the utmost importance.

In case of a long or steep grade it may be possible to arrange an endless cable passing around a drum, fitted with a brake at the upper end of the incline. Each end of the cable is attached to a car or train of cars so that the loaded cars descending haul up the empty cars. On level track or ordinary grades the cars can be hauled by steam or by gasoline locomotives or sometimes can be advantageously hauled by a hoisting engine pulling them directly up a continuous grade or operating an endless rope to pull them both ways if necessary.

Sometimes provision for the delivery of macadam materials or aggregate for concrete pavement will justify the construction of a service track on or alongside the roadbed for the full length or for successive sections. In this case arrangements should be made for the installation of this track in advance of the excavation so as to use it also for hauling the spoil.

MISCELLANEOUS EQUIPMENT

On a contract of this magnitude it may be desirable to start operations at various points simultaneously and to use different equipment in different places changing from place to place as the work progresses. Under such circumstances standard equipment already possessed by the contractors may be advantageously used to expediate the work or to connect other portions of it or to save the movement, purchase or installation of other equipment, even when it is not intrinsically best adapted for this purpose.

For instance, a small hill or knoll may be excavated advantageously by a clam-shell bucket operated by a derrick boom or even by a drag line bucket.

So also trucks, trailers, and wagons of miscellaneous type may perhaps be utilized for removing the spoil if there is a tractor to haul them.

Victoria Bridge Floor Burned

Most of the wooden highway floor on 14 spans of the Victoria Bridge across the St. Lawrence River at Montreal were burned August 22nd causing a loss of about $300.000 and the suspension of traffic for only four days when the roadway was again opened. The full resources of material and labor of the Grand Trunk Railway Co., the owner of the bridge, were devoted to the repairs to the wooden deck, and some of the steel stringers which had to be replaced. While the work was in progress transportation was provided by temporary ferry service.

Immigration Notes

The education of immigrants arriving at industrial plants in Massachusetts was discussed and planned at the recent special conference at Plymouth, Mass., held under the auspices of the state department and the Associated Industries of Massachusetts. The legislature has authorized the Board of Education where cities and towns have the education of persons more than 21 years old that are unable to speak or read English.

The program included papers on:

"Co-operation from the Public Schools." Dr. Payson Smith, commissioner of education for Massachusetts.

"Co-operation from Industry," Charles A. Andrews, president of Associated Industries of Massachusetts.

"Progress in Immigrant Education in Massachusetts Industries During the Past Year." George F. Quimby, industrial service secretary, Associated Industries of Massachusetts.

"How to Secure and Maintain School Attendance."

"Schooling of the Immigrant." (Report of the Carnegie Foundation Study). Frank V. Thompson, superintendent of schools, Boston.

"The point of View of the Worker."

"The Function of the Y. M. C. A. in Industrial Americanization." Dr. George W. Tupper, industrial secretary, Young Men's Christian Associations of Massachusetts and Rhode Island.

"Americanism—Its meaning." William McAndrews, associate superintendent of schools, New York city.

Report of committee on State policies.

Action of recommending of committee.

There were also 36 arranged discussions on various educational subjects, talks from industrial leaders, and school supervisors that have conducted classes, and conferences of industrial and of school groups. A feature of the conference was a complete exhibit of what Massachusetts is doing in immigrant education.

The arrivals at the port of New York, on September 4, 5, and 6 amounted to 36,746 of which 20,538 were steerage passengers besides 6,781 seamen and a large number of immigrants among the 6,421 cabin passengers. The steamer "Amerika" alone brought 6,200 steerage passengers most of whom were Polish refugees.

LABOR NOTES

The announcement of the co-ordination of all the labor unions in Greater New York means that about one million men in the Metropolitan District are now united in a single central organization which means to control them as a unit and if successful in this will possess a weapon of tremendous power for the enforcing of any demands or dictation that they may choose to present to their employers or to the public. Carried to its logical conclusion this simply means that Samuel Gompers or any other leader in control of the big union will have the power to absolutely paralyze the whole city at will. Defenses against such a catstrophe are imminently necessary.

Waterproofing an Old Stone Arch Soffit

A 58-foot stone arch 150 feet long carrying the Raritan canal over a double-track railroad at Trenton, New Jersey, was cured of bad leaks by depositing from 4 to 6 inches of fine concrete over the arch soffit with a concrete atomizer.

The wet surfaces of the stones, some of them very smooth and glassy, were heated until the moisture had been evaporated and they became dry, using steam at 100 pounds pressure from a 35-h.p. boiler, superheated to about 300 degrees and delivered through a 2-inch pipe over small areas of the arch surface.

1:3:2 concrete made with fine gravel was jetted at 50 pounds pressure against the hot stones and set before the water could force its way through. When the gravel was omitted, the concrete would not adhere to the surface, the action of the pebbles apparently being to hammer the hot mortar into the cracks. This concrete surface is satisfactory and watertight, and has endured three winters without cracking or peeling. The work was described by Harold T. Brown in a recent issue of the *Contractor's Atlas.*

Increased Efficiency of Columbus Lighting Plant

It has been stated time and again that when a municipal lighting, water or other public utlity plant fails to prove a success, it is generally because of inefficient management, either because the manager himself is inefficient or because he is prevented by politics from doing his best. Apparently an illustration is afforded by the municipal lighting plant of the city of Columbus.

About June 1st of this year, David E. Huston was made superintendent of this plant, and at that time seven boilers were in service and approximately 3,000 tons of coal was being used per month, and it was said that it was with difficulty that the plant was able to furnish the desired amount of current with all seven boilers in operation. During the latter part of July only five boilers were found necessary and during that month the amount of coal used was 190 tons less than had been the previous average. During the first half of August only 994 tons of coal were used, being 471 tons less than the first half of June. As coal is costing the city $10 a ton placed under the boilers, this apparently means a saving of more than $9,000 a month.

A steam turbine had been installed but had been considered by the officials as a white elephant, but Mr. Houston, about the middle of August, reported that he hoped to have this in operation in a very short time and that then the entire load could be carried by two boilers. Moreover, instead of being unable to give satisfactory service to all of its customers, the plant is now working for new commercial and residence lighting contracts. Superintendent Huston says that he belives that formerly certain interests were trying to discredit the lighting plant and that, with many of the employees either disloval or incompetent, it was nearly at the point of failure.

Recent Legal Decisions

CONTRACTOR'S BOND IS AN INSURANCE NOT SURETY CONTRACT

The Indiana Appellate Court holds, Everly v. Equitable Surety Co., 127 N. E. 616, that a contractor's bond, by which a surety for a certain consideration agrees to indemnify a general contractor in a stipulated sum against loss through a default of a subcontractor, is a contract of guaranty insurance and not one merely of suretyship, so that a waiver of conditions thereof, such as a condition that suit thereon shall be brought within 12 months from the first breach of the contract, may be established by parol evidence.

CONTRACTOR'S DAMAGES AGAINST MUNICIPALITY FOR UNWARRANTED TERMINATION OF CONTRACT

In a contractors' action against a city for the unwarranted termination of a bridge contract, the defense was that the contractor had unduly delayed the work, The Connecticut Supreme Court of Errors holds, Edward De V. Tompkins v. City of Bridgeport, 110 Atl. 183, that neither the contract itself, nor the contractor's knowledge of the work confronting him, should be read as demanding the impossible, or as limiting him to that degree of achievement, if a meaning so repugenant to the presumed purpose and intent of the parties can be reasonably worded. After the contractor had undertaken the work the specifications were found to be ambiguous and inconsistent and impossible of fulfilment. The city's consulting engineer, who was by the contractor made the arbiter of all disputes calling to question the meaning of his specifications, did not approve plans submitted by the contractor making possible the continued construction of the work until six months after the date originally fixed. It was held that the city, and not the contractor, was chargeable with the resulting delay in proceeding with the work. The city was therefore not entitled to terminate the contract under the provision thereof entitling it to do so upon the contractor's delay in the prosecution of the work without fault of the city.

There were several rulings on the admission and exclusion of evidence. It was held that the admission of evidence by the contractor's president that work on the contract had been retarded by the city's termination of another contract with the contractor was proper on the issue of delay. Evidence as to the breaking of concrete slabs, while being removed by ordinary methods to places in the substructure of the bridge was admissible, because the city, having prescribed the construction of the slabs, was chargeable with delay caused by their breaking. The admission of expert testimony that the method by which the city had desired the contractor to do the work was improper and unsafe, and that the city would not have been justified in proceeding to construct the work by that method, was held proper. Evidence as to the bridge commission's instructions to the city's consulting engineer before the plans and specifications were framed was held inadmissible. Expert testimony was admissible on the question of whether the specifications were ambiguous and inconsistent and impossible of literal fulfilment. The exclusion of evidence as to what the city did to repair a claimed defect was held proper.

The allowance of damages to the contractor for expenditures made was held proper as against the contractor that it was being reimbursed from damages resulting from its own delay. The contractor's measure of damages for the city's unwarranted termination of the contract was the loss already sustained, including the expenses already incurred toward performance and the profit he would have realized by performing the whole contract. It was assumed by the court that the expenses incurred by the contractor towards performance were incurred in the fair endeavor to perform the contract, and the burden of proving that they were foolishly or unreasonably incurred was upon the city. The city was liable for the contractor's anticipated profits from the work; the mere fact that the city would have been justified in terminating the contract if the contractor had been responsible for the delay did not protect the city from this liability. Anticipated profits cannot be proved with absolute certainty, and no greater degree is required in such cases than in other civil actions. Where prospective profits are not too speculative and remote, and where they do arise directly and as a natural consequent out of the injury, they are always allowed as an element of damages. An allowance of $159,759.97 as damages was held under the circumstances, not excessive, though the contract price was only $270,120.

WHEN MECHANICS' LIENS DATE BACK TO BEGINNING OF IMPROVEMENT

The lien of a mechanic or contractor, under the Oregon statute and similar statutes, is preferred to the lien of a mortgage or other incumberance which may have attached to the land subsequent to the time when the building or improvement was commenced, or the materials were commenced to be furnished and placed upon and adjacent to the land and so of a mortgage or other incumbrance which was unrecorded as the time such building, structure, or other improvement was commenced, etc. It is held, Colonial Trust Co. v. Vale-Oregon Irr. Co., 265 Fed. 398, that under a statute like this the lien of the mechanic or contractor relates back to the commencement of the building structure, or other improvement, and this whether the particular contract or arrangement under which the work was done was entered upon, or the work was so done, subsequent to the time of the attachment of the mortgage or other incumberance or not.

NEWS OF THE SOCIETIES

September 27-30 — ILLUMINATING ENGINEERING SOCIETY. Annual convention Cleveland. H. Wolf, Builders Exchange, Cleveland, chairman Registration Com.

Sept. 27-Oct. 1—NATIONAL SAFETY COUNCIL. Ninth annual safety congress at Milwaukee. W. H. Frater, treasurer and business manager, 168 North Michigan avenue, Chicago.

Sept. 28-29—NATIONAL LUMBER MANUFACTURERS ASSOCIATION. Lumber Standarizing Conference with architects, engineers, contractors and dealers, Congress Hall, Chicago.

October 8 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. First fall meeting Philadelphia. Sec., 33 W. 39th St., New York.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention, Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference, Springfield, Mass. President, Kenyon, L. Butterfield, Amherst, Mass.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 15-17—CITY MANAGERS, ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting. New York Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

AMERICAN ASSOCIATION OF PORT AUTHORITIES

At the Convention of the American Association of Port Authorities, to be held in Chicago in October it is expected that papers will be presented by

John Meigs, President Society Terminal Engineers, on "The Port of Wilmigton, Del."

Lt. Col. G. H. Kirkpatrick, Chairman of the Harbor Commission, Vancouver, B. C., on "The Port of Vancouver and its Proposed Development."

Charles B. Moores, Chairman of the Commission of Public Docks, Portland, Ore., on "Portland's Past, Present and Prospective Relation to the Commerce of the Pacific."

Carrol W. Simon, Philadelphia on "Dry Docks, and Ship Repair Plants as Necessary Auxiliaries of Well-Balanced Ports."

Hon. Calvin Tomkins, New York, on ,'Standardized Unit Containers to Facilitate Terminal Handling and Distribution."

John H. McCallum, President Board of State Harbor Commissioners, San Francisco, Cal,, on "The Harbor—San Francisco's Greatest Asset."

Dr. R. S. MacElwee, Director of the Bureau of Foreign and Domestic Commerce, Washington, on "The Quay and Warehouse vs, the Pier System."

William T. Donnelly, Consulting Engineer, New York, on "Harbor and Terminal Facilities and Relative Despatch of Land and Water Transportation."

A. R. Smith, New York, on "The Port of New York—the Greatest Port in the World."

Col. John Millis, Corps of Engineers, Central Department U. S. A., it is expected, will deliver an address on "Nature's Preparations for Deep Water Harbors on the Great Lakes."

NEW ENGLAND WATER WORKS ASSOCIATION

The 39th Annual Convention of this association was held in Holyoke, Sept 7 to 10. The total attendance was about 300. The program was unusually lengthly, including approximately 50 papers and committee reports. The program of the convention was published in the August 28th issue of PUBLIC WORKS. In addition to the papers therein named, the committee on Standard Specifications for Cast Iron Pipe reported that little had been done by the committee since 1917 because of inability to obtain the co-operation of the pipe manufacturers; but that recently the chairman, Frank McInnes, and another member of the committee had visited several southern pipe foundries and effected an understanding whereby tests are to be made to settle some of the disputed points.

W. C. Hawley, chairman of the committee on Charges for Private Fire Protection, recommended that charge be made for private fire protection based on the cost of the service. Of two representatives of fire insurance companies on the committee. one agreed to the general conclusions of the report but the other was expected to submit a minority report, and the convention therefore continued the committee until this minority report could be submitted sometime during the winter.

The committee on rainfall and run-off measurements, Robert E. Horton, chairman, submitted a final report giving data supplementory to those submitted by the same committee in 1914, each record being accompanied by a description of the governing conditions and several of them including evaporation records.

Albert L. Sawyer, chairman of the committee on Uniform Accounting, submitted a preliminary report which included an outline of a simple system of water works accounting; which report will be discussed at one of the winter meetings of the association.

A discussion was held on the recommendation of a committee that bonds be used instead of certified checks in submitting bids, the difference between the lowest bid, if withdrawn, and the one accepted being collected on the bond; there being a division of opinion on this subject, one member believing that a check was cash while a bond was a law suit. This matter also was postponed to a later meeting. The committee on Assessments for Main Pipe Extensions, Caleb Mills Saville, chairman, reported progress.

The Dexter Brackett Memorial Medal for 1919 was presented to Robert E. Horton of Voorheesville, N. Y., for his paper on "The Measurement of Rainfall and Snow"; this medal being awarded annually to the author of the most meritorious paper, from the viewpoint of service, presented during the previous year.

Several of the papers received interesting discusion, in spite of the length of the program. Henry W. Clark's paper on "Innocence or Repentance in Drinking Waters" was followed by a written discusion of the same by George A. Johnson, who accused the Massachusetts State Board of Health of undue conservatisn in refusing to endorse filtration and chlorination for Massachusetts cities, claiming that there can be no insurance against polution of water supplies and that treatment to destroy the dangerous impurities is therefore necessary in every case. Mr. Clark replied that "Massachusetts stands on its record," which shows that during the past thirty-five years the typhoid fever rate of the state has fallen from 45 per hundred thousand to 2.5, and that this has been secured by comparatively little filtration or chlorination, but rather by safeguarding the supplies and excluding untreated sewage from the streams.

In a discussion on the use of trenching machines, several members reported having used them to great advantage, including George W. Batchelder, water commissioner of Worcester, and A. E. Martin of Springfield. The latter reported that he had recently purchased a gasoline power machine for $7200 plus freight, which he has used not only for trenching but also for removing a 16-inch main and lowering a 30-inch one

IRRIGATION AND DEVELOPMENT CONGRESS

The Irrigation and Development Congress held in Seattle Sept. 16 and 17 for the cities of Oregon, Washington and Montana represented hundreds of towns with an attendance of about 2,000 delegates composed of representative business men, ranchers, county comissioners, engineers and commercial organizations and others. The State Irrigation Commission of Montana was represented by C. S. Heidell, state engineer, Captain J. Winter Smith and Fred E. Buck. Important politicians, editorial and industrial officers were present from various localities and districts in groups of ten to one hundred indicating a hearty interest in the important subjects under consideration.

LOUISIANA ENGINEERING SOCIETY

At the regular meeting of the Louisiana Engineering Society held September 13, the technical exercises consisted of a paper entitled, "Relation of Change in Storm Tides on the Coast of the Gulf of Mexico to the Centre and Movement of Hurricanes," by Dr. I. M. Cline, District Forecaster, Weather Bureau, New Orleans.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

NOVALUX STREET LIGHTS

Bulletin 43503 B. of the General Electric Company is devoted to Novalux ornamental street lighting units intended not only to illuminate but to beautify streets and buildings. The type of unit, size of lamp and distance between lamps depends on the width and importance of the street, the size of the city, character of the road surface, buildings, amount of shrubbery and trees, and local requirements for distributing electricity. The lighting developmental, and research organization of the General Electric street lighting specialists and engineers with laboratories at Lynn and at the Edison and National Lamp Works at Harrison, New Jersey, at Cleveland, Ohio, and at Schenectady, are available to study the conditions and recommend efficient lighting plans and equipment.

Single light standards can be more widely spaced than clusters and with slender and graceful poles, give a less conspicuous installation and lend themselves to more artistic treatment that harmonize with architectural surroundings. It is possible to obtain 20 per cent increase of light and 10 per cent saving in electricity by the use of large lamps as well as to reduce the absorbtion of light by globes. The downward light is practically the same for single and cluster units but upward light is about 50 per cent greater and the cost of globes, fixtures sockets, etc., is much more for clusters than for single lights.

The Novalux lights include the Flemish type with rather severe simple lines. Each unit is shown in two sizes one for "White Ways" and the other for parkways.

The form H. unit has been designed particularly for the straight series of multiple Mazda lamps and for the high current series lamp operated from type I L transformers. The casing is designed to be attached to the top of an ornamental pole 5 inches in diameter at the top. The construction is the simplest possible, consisting of only the casing, socket, receptacle, lamp, globe, and top ornament. One style is made with a disffusing globe at the metal canopy distributing the light without glare. It is provided with a reflector in the top of the globe and a ventilating screen between it and the canopy. Another style differs from this only in having a glass instead of a metal conopy.

A lamp with a rippled globe and dome refractor is recommended for ornamental lighting in boulevards, parkways and beautiful residential districts. The rippled glass has minute protuberances and depressions that diffuse the light by breaking it up, and is more efficient than any other type of diffusing glassware. The entire globe sparkles with light.

Form 9 of the Novalux for Mazda C lamps is made for all sizes of straight series lamps, and high current lamps. The style recommended for White Way lighting using lamps of 600 and 1,000 candle power, has a reflector and an aluminum ventilating screen. Another larger style with rippled globe and dome refractor is suitable where upward light is not required and an ornamental unit is preferred. Another pattern with 8 panel diffusing globe provides for the illumination of building fronts and street surface. It is made with a cast iron frame and suspended reflector.

The eight-panel stippled globe and dome refractor unit is recommended for the largest Madza lamps up to 1,500 candle power for White Way lighting to give an intense flood of light on the streets.

STANDARD WATERWORKS GAUGES

The gauges manufactured by the Builders Iron Foundry have their interior mechanism of bronze, aluminum and other metal to withstand corrosion from damp atmospheres. The indicator dials are of metal, machine-engraved and finished in black with white enamelled figures and letters. The exterior finish of all gauges is in black "egg-shell gloss."

Water level Gauges are operated by a spherical float traveling in a vertical float pipe. Usually the gauge is set directly over the float pipe which may be located at a considerable distance from the tank or reservoir by connecting the two at the bottom with a small pipe. If desirable the gauge can also be placed a short distance from the float pipe by leading the float cord over special idler pulleys. The dials or charts are graduated in depth in feet or in elevations figures.

Loss of head gauges are designed to show the loss of head due to a filter. They are operated by two floats moving in verticle float pipes, one communicating with the water on the filter and the other with the water in the effluent pipe. The graduations are in feet.

Rate of flow gauges are usually used in connection with venturi effluent rate controllers; they also may be employed with a venturi meter tube. They are operated from two float pipes, one connecting with the inlet and the other with the throat of controller or meter tube. The graduations are directly in rate of flow units—usually gallons per day.

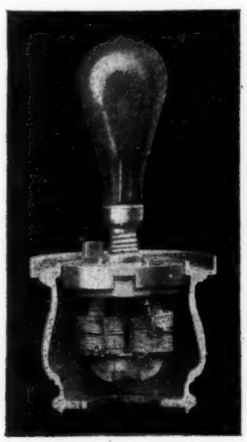
NOVO PUMPS

The portable diaphragm pump outfit manufactured by the Novo Engine Company is mounted on a small truck which also is equipped with a gasoline engine operating the pump that is made in five sizes with capacities of 3,500, 4,000, 4,500, 10,000 and 12,000 gallons per hour. They are operated by 1½ 2 and 3 h.p. motors and will raise water to a height of 20 feet to the outlet from which it must flow away by gravity.

CENTRIFUGAL PUMPS

The direct connected centrifugal pump units manufactured by the Novo Engine Company are mounted either on a cast iron bed or on a small truck and are driven by the Standard Novo

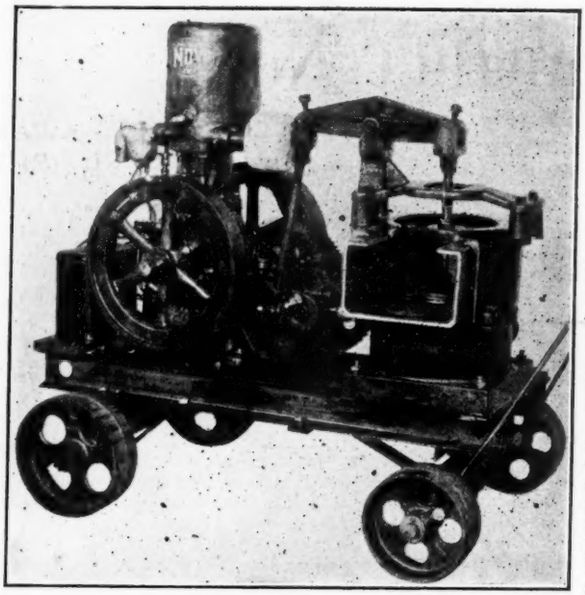
FORM 8 UNIT



FORM 9 UNIT

RIPPLED GLOBE AND DOME REFRACTOR

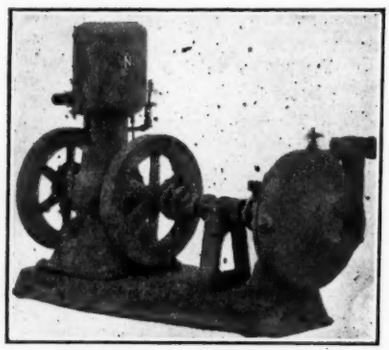
DIFUSING GLOBE AND GLASS CANOPY



NOVO DIAPHRAGM PUMP

gasoline engine directly connected to the pump shaft.

They are built in five sizes with a capacity of 50, 75, 125, 600, and 800 gallons per minute to a total head of 20 feet or with correspondingly larger capacities for lower heads. For these services they require from a half to 10 h.p. and have suction pipes varying from 2 to 8 inches and discharge pipes from 1½ to 6 inches in diameter.



NOVO CENTRIFUGAL PUMP

KREMER SOLIDAIR TIRES

The non-puncturable tires manufactured by the Kremer Solidair Tire Corporation, for commercial and heavy trucks make the solid tire practical, as the pneumatic cushion occupies the space between the wooden wheel and the outer steel rim on which the solid rubber tread is vulcanized.

The Kremer "Solidair" Tire starts with air as a working basis and from this develops the various units to make up the complete assembly which results in the "Solidair" equipped truck, literally "riding on air."

First in this assembly is the ordinary wooden wheel. On this is provided space for a pneumatic tube which, unlike the ordinary pneumatic is not contained within the shoe but is independent of it and entirely protected from injury or puncture.

Upon this rests a solid rubber tread, approximately semi-spherical in shape, which is the only portion of the "Solidair" Tire coming into direct contact with the road.

On both sides of the pneumatic tube and extending up on both sides of the solid rubber tread are two steel flanges forming an absolute protection to the pneumatic tube and the sides of the tread.

The outer flange is removable just as the ordinary demountable rim, bolting on studs which secure it firmly to the wheel. In the Kremer "Solidair" Tire, there are no springs or complicated parts. It is as easily assembled as the ordinary pneumatic. No special tools are required and it is not necessary to carry a spare wheel. Impossible to pucture. It is claimed that the life ofthe Solidair is longer than the life of the old solid tire. The initial cost is not high. It is not necessary to carry emergency equipment or a spare wheel or tire for the reason that if a tube should prove defective (which is the only possible cause of puncture in the Kremer "Solidair") it will deflate only about one inch and then becomes an ordinary solid rubber tire, which can be run on without injury and without interrupting the work of the truck; for this reason none of the difficulties of making road repars are present in the Kremer "Solidair." There is no reduction of high-gear ability on account of larger diameter of wheel. There are no limitations on the size of the brakes as the wheel diameter of the "Solidair" is the same as that used with solid rubber tire.

The solid tire absorbs the strains and stresses of the road in every direction; forward or backward up and down or lateral through the pneumatic cushion. It is so constructed that it carries the load distributed over forty per cent of the circumference of the wheel not on a contact of 4 to 6 inches.

The air cushion base is claimed to *increase tire mileage one hundred per cent* and the life of the truck is lengthened as there is less wear, tear and depreciation.

BETHLEHEM NEW 2-CYCLE DIESEL ENGINE

This engine, invented by Arthur West, head of the power department of the Bethlehem Steel Corporation, is an improvement on the European engines that are not adapted to service in America where the crews are not used to many fine adjustments and delicate mechanism.

Hitherto, sucessful heavy oil combustion engines have been of the 4-cycle type in which only every fourth stroke of the piston is a power stroke. In the 2-cycle engine, every second stroke is a power stroke, thus producing twice as powerful a machine as the 4-cycle engine of the same size. The difficulties that have hitherto prevented the development of the 2-cycle type have been overcome in this engine by the use of water cooled jacket and a method of economizing the oil feed into the hot compressed air.

The new engine is designed for power plants of any size and develops twice the power of a 4-cycle engine of the same size while saving two-thirds in the cost of fuel. It burns heavy oil that is sprayed in liquid form by compressed air in the cylinder to cause combustion that produces the power.

One of these engines after successful service in the auxiliary power plant of the Bethlehem Steel Corporation at Bethlehem Pennsylvania, was installed on the steamship Cubore where it gave very satisfactory results in the development of power, reliable action, great fuel economy and saving of cargo space.

INDUSTRIAL NEWS

WILLITE ROAD CONSTRUCTION COMPANY

This company, like many others, has been prevented in carrying out its entire 1920 program by delay in delivery of materials and by labor conditions. However, it has constructed or has now under construction the following contracts: In Niagra Falls, Canada, 50,000 yards completed and an additional 50,000 under construction. In Kingston, N. Y., 50,000 yards completed and 50,000 under constuction, which will bring the total in that city up to more than 20 miles. In Albany, N. Y., the company is about to start work on resurfacng a whole concrete pavement. In Richmond, Va., 6,000 square yards has been completed and 24,000 yards will probably be added before winter. In Rowan County, N. C., 3 miles of Federal Aid road. In Atlanta, Ga., 20,000 yards completed and 30,000 to be constructed. In Lima and Spencerville, Ohio, work will soon begin. In Michigan, resurfacing has been completed at Mount Clemens and will soon be begun on a 3 mile stretch near Pontiac. Mena, Ark., has contracted for 10,000 square yards. At Weatherford, Texas, a large yardage is being laid; in addition a number of concrete state roads have recently been resurfaced with Willite. In Bend, Oregon considerable pavement is under construction. In California, Willite surfacing is being laid on one mile of concrete in Los Angeles county and Willite base and surface is being constructed in Imperial county.

Chris D. Schramm & Son, Inc.

This company announces that it has changed the location of is administration offices from Philadelphia to West Chester, Pa., the location of the factory. The Philadelphia offices at 709 Arch Street will be retained as a sales office only. The object of the change is to render a more efficient and direct service to its customers.